

UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT-EASTERN STATES  
Northeastern States Field Office  
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Milwaukee, Wisconsin 53202-4617

In Reply Refer to:  
3120 (003000)  
NEPA #DOI-BLM-ES-0030-2013-0027-EA  
EOI-351/1006

October 6, 2014

Memorandum

To: Eastern States, State Director (ES-930)

From: Field Manager

Subject: Recommendation to Offer Split-Estate Lands in Bradford County, Pennsylvania for Competitive Oil and Gas Leasing.

By letter dated October 29, 2009, an Expression of Interest (EOI-351) for oil and gas leasing was received by the Northeastern States Field Office (NSFO) from the Eastern States Office (ESO) for lands totaling approximately 5,194 acres in Bradford County, Pennsylvania. Also, by letter dated April 6, 2010, an Expression of Interest (EOI-1006) for oil and gas leasing was received by the NSFO from the ESO for the same overlapping lands. All of the lands nominated under EOI-351 and EOI-1006 are state of Pennsylvania lands overlying 75% federal minerals and 25% state minerals. These lands were previously analyzed for environmental impacts in September 2013 for the March 2014 lease sale but were removed from consideration awaiting Endangered Species Act consultation response from U.S. Fish and Wildlife Service. This response was received by letter dated March 19, 2014. Final action has now been taken on these lands.

The NSFO has prepared an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) addressing the split estate lands nominated under EOI-351 and EOI-1006 (enclosed). Based upon the EA, comments received on the EA, and the ability of the potential lessee to access the federal minerals from off lease, it is my recommendation that the lands be offered for competitive oil and gas leasing, subject to no surface occupancy on State Game Lands 219 and the BLM lease notices and stipulations found in Appendix B of the EA.

Please return one copy of the signed FONSI and Decision Record to the NSFO for our records. We are retaining a copy of the EA for our records. If you have questions regarding this memorandum, please contact Randy Anderson at (414) 297-4421 or by e-mail at [r35ander@blm.gov](mailto:r35ander@blm.gov).



2 Attachments:  
Environmental Assessment  
Finding of No Significant Impact

## **FINDING OF NO SIGNIFICANT IMPACT**

### **Environmental Assessment**

#### **Expressions of Interest 351 and 1006**

***DOI-BLM-ES-030-2013-0027-EA***

The proposed action is for the BLM to offer the federally owned oil and gas resources in State Game Lands 219, Warren Township, Bradford County, Pennsylvania, containing 5,194 acres, on the next available Eastern States competitive oil and gas lease sale.

There are no surface disturbing activities proposed at the leasing stage. However, it is reasonable to expect the development of one or more wells in the future. When an Application for Permit to Drill (APD) is proposed for these lands, a site specific NEPA document will analyze the effects of the development.

Based on the analysis of potential environmental impacts contained in the Environmental Assessment (DOI-BLM-ES-030-2013-0027-EA), and considering the significance criteria in 40 CFR 1508.27, I have determined that the proposed action will not have significant impacts on the human environment. Therefore, preparation of an environmental impact statement is not required prior to approving and implementing the proposed action.

Authorized Officer:

\_\_\_\_\_  
Tony Herrell, Associate State Director  
Eastern States Office

\_\_\_\_\_  
Date

United States Department of the Interior  
Bureau of Land Management  
Northeastern States Field Office  
LLES003410

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## Environmental Assessment

NEPA #: DOI-BLM-ES-030-2013-0027-EA

### Expressions of Interest 351 and 1006

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**Date:** October 2014

**Type of Action:** Oil and Gas

**Serial Number:** N/A

**Location:** Pennsylvania State Game Lands 219, Warren Township, Bradford County

**Project Acreage:** 5,194 acres

**Proponent Address:** Proprietary

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Northeastern States Field Office

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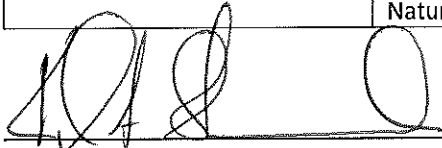


## MISSION STATEMENT


It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

**Technical Review.**

Program	Reviewer	Initials	Date
Air Quality	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Climate Change	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Cultural/Paleontology	Jarrold Kellogg Archeologist		
Environmental Justice	Kurt Wadzinski Planning & Environmental Coordinator	KW	10/2/14
Fish and Wildlife	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Geology/Mineral Resources/Energy Production	Jeffrey Nolder Geologist		
Hazardous Wastes	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Invasive Species/Noxious Weeds	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Native American Religious Concerns	Jarrold Kellogg Natural Resources Specialist		
Recreation	Jarrold Kellogg Archeologist		
Socioeconomics	Kurt Wadzinski Planning & Environmental Coordinator	KW	10/2/14
Soils	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Special-Status Species	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Vegetation	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Visual Resources	Kyle Schumacher Natural Resources Specialist	KS	9/29/14
Water Resources and Wetlands	Kyle Schumacher Natural Resources Specialist	KS	9/29/14

  
Preparer

10/02/2014  
Date

  
Planning & Environmental Coordinator

10/2/2014  
Date

  
Associate Field Manager

2 OCT 14  
Date

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## **CHAPTER 1 – PURPOSE OF AND NEED FOR ACTION**

### **Purpose of the Proposed Action**

The purpose is to consider opportunities for private individuals or companies to explore for and develop federal oil and gas resources through a competitive leasing process. A federal oil and gas lease is a legal contract that grants exclusive rights to the lessee to develop federally owned oil and gas resources.

### **Need for the Proposed Action**

The tracts considered for lease in this analysis were nominated by Expressions of Interest (EOIs) from private industry. The oil and gas leasing program managed by the Bureau of Land Management (BLM) encourages private exploration and development of domestic oil and gas reserves and the reduction of U.S. dependence on foreign sources of energy and is essential to meeting the nation's future needs for energy. The BLM's oil and gas leasing programs are codified under the authority of the Mineral Leasing Act of 1920, as amended, the Mineral Leasing Act for Acquired Lands of 1947, as amended, the Federal Land Policy and Management Act (FLPMA) of 1976, and the Energy Policy Act of 2005.

On October 29, 2009, the BLM Northeastern States Field Office (NSFO) received a request (EOI-351) from the BLM Eastern States Office (ESO) for a National Environmental Policy Act (NEPA) analysis for 5,194 acres of State Game Lands (SGL) 219. On April 6, 2010, the NSFO received a request (EOI-1006) for the same overlapping lands as EOI-351. The Pennsylvania Game Commission (PGC) manages the surface of the nominated area.

### **Management Objectives of the Action**

Since the BLM does not manage the surface, the sole management objective of the BLM is to make federal minerals available for economically feasible development without causing undue, negative impacts to natural resources.

### **Conformance with BLM Land Use Plan(s)**

The proposed action does not conflict with any known State or local land use plan, ordinance or zoning. The BLM has not developed a comprehensive land use plan for BLM-administered resources in the Commonwealth of Pennsylvania, but is in the initial stages of developing a five-state Resource Management Plan (RMP) and associated Environmental Impact Statement (EIS) that includes Pennsylvania. When oil and gas leasing and non-energy solid mineral leasing are proposed in an area not covered by a Resource Management Plan (RMP) or other applicable LUP (Land Use Plan), an Environmental Assessment (EA) may be used as a basis for a decision on the proposal (43 C.F.R. § 1610.8(b)(1) (2005)), provided that there is an opportunity for the public to provide input during the process. BLM Instruction Memorandum No. WO-2010-117 states that, "State and field offices will provide for public participation as part of the review of parcels identified for potential leasing through the NEPA compliance documentation process. State and field offices will identify groups and individuals with an interest in local BLM oil and gas leasing, including surface owners of split estate lands where Federal minerals are being considered for leasing. Interested groups, individuals, and potentially



affected split estate surface owners will be kept informed of field office leasing and NEPA activities through updated websites and email lists, and will be invited to comment during the NEPA compliance process.”

Notice of initiation of this EA was posted to the Eastern States public website on the 2013 NSFO NEPA Log on September 11, 2013. Additionally, the ESO leasing process incorporates a mandatory 30-day public comment period on all completed EAs and unsigned Findings of No Significant Impact (FONSI) for potential lease parcels on the ESO public website. Public notices appeared in the *Towanda Daily Review* and the *Williamsport Sun Gazette* for two consecutive weeks starting on April 9, 2014, soliciting public comments on the EA. The 30-day public comment period ended on May 8, 2014 with the BLM receiving eleven responses. Responses to these comments are summarized in the Decision Record and incorporated into this EA.

### **Relationship to Statutes, Regulations and Other Plans**

This EA was prepared in accordance with the NEPA of 1969 and in compliance with all applicable regulations and laws passed subsequently, including Council on Environmental Quality (CEQ) regulations (40 C.F.R., Parts 1500-1508), U.S. Department of the Interior (DOI) requirements (Department Manual 516, Environmental Quality), the National Historic Preservation Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, Executive Order 13007 (Indian Sacred Sites), guidelines listed in BLM’s NEPA Handbook, H-1790-1 , and/or other Federal statutes and executive orders. This EA also complies with the following PGC planning guidance documents, the *2009-2014 Strategic Plan* and the *Comprehensive Management Plan for State Game Lands 219*, both available from the PGC.

The purchaser of a Federal oil and gas lease is required to comply with all applicable Federal, State, and local laws and regulations and obtain all required permits prior to the commencement of project activities.

### **Decision to Be Made**

The BLM will decide whether to offer the Federal oil and gas mineral estate for competitive leasing. The BLM’s policy is to promote oil and gas development if such action meets the guidelines and regulations set forth by the NEPA of 1969 and other subsequent laws and policies passed by the U.S. Congress.

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## **Scoping and Issues**

### **Rationale for conducting external scoping**

The BLM elected to conduct external scoping for two reasons. First, the decision area includes a state-managed, public hunting area. The BLM recognizes that the state property managers have critical information regarding many surface natural resources that may be impacted by the proposed lease. Second, the Commonwealth of Pennsylvania owns a 25% interest in the minerals, and it is best for the BLM and the Commonwealth to coordinate their natural resource assessment to maintain consistency.

### **Process for conducting external scoping**

The BLM met onsite with PGC staff on June 11, 2013, and continued its correspondence with the PGC through e-mail, telephone, and data sharing through the period of time leading up to the drafting of this EA. The names of the participants are listed in **Chapter 5 - Persons, Organizations, and Agencies Consulted**.

### **Issues identified through internal and external scoping**

Following are the issues that were identified through internal and external scoping:

1. SGL 219 contains various intensive-management areas whose management goals are inconsistent with oil and gas surface development.
2. SGL 219 is used for hunting, which is intensive at various times throughout the year. The PGC will prohibit drilling activities during certain times of intensive hunting activity.
3. SGL 219 and the surrounding region contain invasive species that may be spread by vehicle traffic and land clearing.

## **CHAPTER 2 – ALTERNATIVES, INCLUDING THE PROPOSED ACTION**

### **Introduction**

The BLM Northeastern States Field Office has received expressions of interest (EOIs) for the Federally owned minerals underlying SGL 219. Competitive leases would provide the lessee(s) exclusive rights to explore and develop Federal oil and gas minerals on the leases but would not authorize surface-disturbing activities or obligate the company to drill a well on a lease. Leases could be used to consolidate acreage to meet well spacing requirements, or a lease may be acquired for speculative value. The BLM would require applicants to adhere to lease stipulations formulated while conducting this EA and are made part of the proposed action.

### **Location**

The site, shown in Figure 1, is located on state-owned land in Warren Township, Bradford County, in northeastern Pennsylvania.

### **Proposed Action**

#### **Well Drilling**

The nominated parcels, if approved, would be offered for competitive sale with stipulations and notices generated through this process and other consultations. Once awarded, the successful bidder would be required to submit an Application for Permit to Drill (APD) and performance bond to the BLM before any ground disturbance would be authorized. In an APD, an applicant identifies a proposed drill site and provides the BLM with specific details on how and when the applicant proposes to drill the well within the constraints of the lease document. Upon receipt of an APD, the BLM conducts an onsite inspection with the applicant and the surface-managing agency, in this case, the PGC. NEPA and Endangered Species Act (ESA) requirements must also be met at the APD stage and, in cases with potential to affect Federally listed or State-listed species, a site-specific biological assessment is written, including the

results of any required biological surveys. This would be submitted to the U.S. Fish and Wildlife Service (FWS) and the PGC for consultation. The lessee would be required, as a condition of approval, to comply with the recommendations of these consultations.

This EA will analyze impacts to natural resources based on the Reasonably Foreseeable Development Scenario (Appendix D), which predicts the development, over the next ten years, of 60 wells on 12 pads. Five of these pads already exist on nearby private land, and three to four of these pads could potentially be constructed on SGL 219. The total area of new ground disturbance is an estimated 42 acres. *This scenario is provided strictly for the purpose of analysis and does not represent the BLM's decision or prediction as to a number of wells that may be permitted under the proposed lease.*

### Hydrocarbon Drilling Methods

Wells drilled to produce hydrocarbons can be drilled either vertically or horizontally. Drilling operations may be drilled vertically if the end of the well, the bottom hole location, is directly below the well pad, or directionally, if the well pad is not directly above the bottom hole location. For example, federal minerals under a state park, where drilling is not permitted in Pennsylvania, can be accessed by directional drilling. The same method may be used to drill horizontally, with a wellbore extending for up to several thousand feet through the hydrocarbon-producing rock formation. In this case, the purpose of non-vertical drilling is not necessarily to provide access to the hydrocarbons but to increase the well's production.

A typical drilling operation, regardless of method, would be as follows:

Oil and gas development typically involves construction of access roads, utility corridors, and a well pad(s) utilizing various pieces of heavy machinery and water supply for dust abatement. Constructed access roads normally have a running surface width of approximately 16-20 feet, the length depending upon the well site location in relation to existing roads or highways. An excavation reserve pit is usually constructed about 5-10 feet deep and is lined with bentonite clay to retain drilling fluids, circulated mud, and cuttings. Plastic or butyl (or equivalent) liners that meet applicable thickness and quality standards are required for holding pit fluids. Where pits cannot be placed, steel tanks are used to collect return material. Drilling of the well(s) typically includes a drill rig, with supporting tanks, generators, pumps, supply trucks, crew housing, drilling supplies, fuel tanks, out houses and various other items to support drilling operations which occur around the clock for approximately 30 to 45 days per well, when much of the equipment is removed unless needed to support completion operations.

Once drilling is completed, excess fluids are pumped out of the pit and disposed of in a state-authorized disposal site and the drill cuttings will either be treated and buried on location or hauled to an approved disposal facility.

Completion operations typically occur over a 10 to 15 day period and require tanks, completion crews, supply trucks, facility and/or pipeline placement and hookup, and well flow back while being placed into production. Completion activities do not always occur immediately following drilling operations due to crew availability/scheduling and wildlife or other seasonal restrictions that may be present. Once the well(s) are placed into production they are typically monitored on a daily basis for production and only

production tanks and facilities remain on the location with the wellhead for the remainder of the production life of the well. At this time the well pad can be pulled in for interim reclamation to shrink the pad footprint for the remainder of the production life of the well pad, when it will be placed into a state of final reclamation requiring state approval before the BLM can release the operator's bond for the lease.

### Vertical Drilling

Wells would be drilled by rotary drilling using water based mud in the freshwater zones followed by setting surface casing to protect freshwater before drilling through the production zone with oil-based muds and setting production casing. Mud pumps would be used to force mud down the drill pipe and up through the annulus, circulating the rock cuttings out the wellbore. Most conventional wells require less than 500,000 gallons of water for completion. Water could be pumped to the site from an approved water well, local pond, stream, or lake through a pipe laid on the surface, if permitted. Water could also be brought to the site in tankers. Some processing equipment or temporary storage may be necessary on site. It is unlikely that vertical drilling will be proposed on SGL 219.

### Horizontal Drilling

Wells drilled horizontally with multiple-stage hydrofracture operations require somewhat larger well pads and reserve pits than conventional vertical or directional wells and would accommodate five or more horizontal wells. The larger pads are required to store the larger amounts of equipment and supplies used in drilling horizontal wells.

Horizontal wells require far more water for completion and produce more drill cuttings than conventional wells. Conventional wells are drilled to and slightly below the depth of the target formation(s), but a horizontal well is drilled to and then into the target formation, with the length of the horizontal portion of the well, known as a lateral, often exceeding the vertical depth of the well. In Pennsylvania, lateral lengths exceeding one mile are common, and the number of fracture stages used to complete a horizontal well are far greater than the number used for a conventional well. Marcellus and Utica shale wells typically consume between three and six million gallons of water for completion. Drill cuttings are typically separated from water by means of closed-loop systems and disposed of in landfills.

In some areas, surface water may be used for drilling and completion, depending on state requirements. Water users must apply for approval by the Susquehanna River Basin Commission (SRBC) for use of any surface water sources. Operators may opt to purchase water from local governments or private sources. When a hydrocarbon well is completed, the produced water, including both the hydrofracture fluids and formation fluids, must be collected in tanks for state-approved disposal.

Horizontal drilling using hydraulic fracturing methods is commonly used for mineral extraction in Marcellus shale formations. Hydraulic fracturing (hydrofracture or "fracking") has been widely used in the oil and gas industry since the late 1940s. The process has allowed hydrocarbon production from tight sandstones, shales and some carbonates. Fracturing is not used in all well completions, but wells in

shale reservoirs are typically completed using hydrofracture. The use of hydrofracture is dependent on the type of reservoir rock encountered in the subsurface.

In the hydraulic fracturing process, water, sand and small amounts of chemical additives are pumped down the wellbore. Holes in the production tubing direct the mixture to the reservoir rock under high pressure, breaking the rock. The water-induced fractures allow the oil and gas to flow into the wellbore. Additives may be added depending upon the type of reservoir rock and fluids encountered at depth. The subsurface pressure forces the hydrocarbons, reservoir fluids and used fracture fluids to the surface. The hydrocarbons naturally separate from the other fluids. The used fracture and reservoir fluids are stored in large tanks for disposal by state-approved methods. In areas where large quantities of water are needed to fracture the rocks, the fluids may be recycled and used in other completion operations.

### **No-Action Alternative**

Under the No-Action Alternative, the request to offer the proposed tract for oil and gas lease would be denied.

## **CHAPTER 3 – DESCRIPTION OF THE AFFECTED ENVIRONMENT**

### **Introduction**

The decision area includes a 7,500-foot buffer around the EOI, since unconventional wells drilled in the vicinity could have laterals about that long, and the buffer excludes the adjacent area in New York, where a moratorium on horizontal drilling is in effect. In the event that the moratorium is lifted in New York, some development may occur from the north to tap the Federal minerals, but the BLM would expect to see roughly the same number of wells proposed for accessing the Federal minerals under SGL 219. The decision area's total area is 20,500 acres (Figure 1). The state-owned portion of the decision area is managed by the PGC for wildlife conservation and recreational use, primarily hunting. SGL 219 consists of woodlands, wetlands, and croplands that are planted with crops to attract game. The non-state-owned lands in the decision area include privately-owned woodlands and farmlands.

The decision area is within the Eastern Temperate Forests level-I ecoregion, Mixed Wood Plains level-II ecoregion, and the Northern Allegheny Plateau level-III ecoregion.

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### **Air Resources**

Air quality and climate are components of air resources that may be affected by BLM applications, activities, and resource management. Therefore, the BLM must consider and analyze the potential effects of BLM-authorized activities on air resources as part of the planning and decision making process.

#### *Air Quality*

The primary sources of air pollution are dust from blowing wind on disturbed or exposed soil, exhaust emissions from motorized equipment, oil and gas development, agriculture, and industrial sources. The Environmental Protection Agency (EPA) has the authority for air quality protection with the provision to

delegate this authority to the state as appropriate under U.S. law. The Pennsylvania Department of Environmental Protection (DEP) Bureau of Air Quality (BAQ) has been delegated most of the authority for air quality protection in Pennsylvania. The Clean Air Act (CAA) of 1970, as amended, requires the establishment of National Ambient Air Quality Standards (NAAQS). NAAQS pollutants include carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM<sub>10</sub> & PM<sub>2.5</sub>), sulfur dioxide (SO<sub>2</sub>), and lead (Pb). The Pennsylvania DEP BAQ monitors the NAAQS pollutants in Pennsylvania. The CAA identifies two types of national ambient air quality standards. Primary standards define levels of air quality that the Administrator of the EPA judges to be necessary, with an adequate margin of safety, to protect the public health. Secondary standards define levels of air quality that the Administrator of the EPA judges to be necessary to protect the public from any known or anticipated adverse effects of a pollutant. Both primary and secondary standards are currently in effect (Table 1).

Bradford County is not in a nonattainment zone according to the EPA (2014a) and the Pennsylvania DEP BAQ (2012).

Table 1. National Ambient Air Quality Standards (U.S. Environmental Protection Agency, 2012a)

Pollutant [final rule cited]	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide [76 FR 54294, 8/31/2011]	9 ppm (10 mg/m <sup>3</sup> )	8-hour <sup>(1)</sup>	None	
	35 ppm (40 mg/m <sup>3</sup> )	1-hour <sup>(1)</sup>		
Lead [73 FR 66964, 11/12/2008]	0.15 µg/m <sup>3</sup> <sup>(1)</sup>	Rolling 3-Month Average	Same as Primary	
Nitrogen Dioxide [75 FR 6474, 2/9/2010] [61 FR 52852, 10/8/1996]	53 ppb <sup>(2)</sup>	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour	None	
Particulate Matter (PM <sub>10</sub> ) 12/14/2012	150 µg/m <sup>3</sup>	24-hour	Same as Primary	
	12.0 µg/m <sup>3</sup>	Annual (Arithmetic Average)	15.0 µg/m <sup>3</sup>	Annual (Arithmetic Average)
Particulate Matter (PM <sub>2.5</sub> ) 12/14/2012	35 µg/m <sup>3</sup>	24-hour	Same as Primary	
	0.075 ppm <sup>(3)</sup>	8-hour	Same as Primary	
Sulfur Dioxide [75 FR 35520, 6/22/2010] [38 FR 25678, 9/14/1973]	75 ppb <sup>(4)</sup>	1-hour	0.5 ppm	3-hour <sup>(1)</sup>

**Note:**

- (1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m<sup>3</sup> as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved. The official level of the annual NO<sub>2</sub> standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
- (2) The official level of the annual NO<sub>2</sub> standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
- (3) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard.

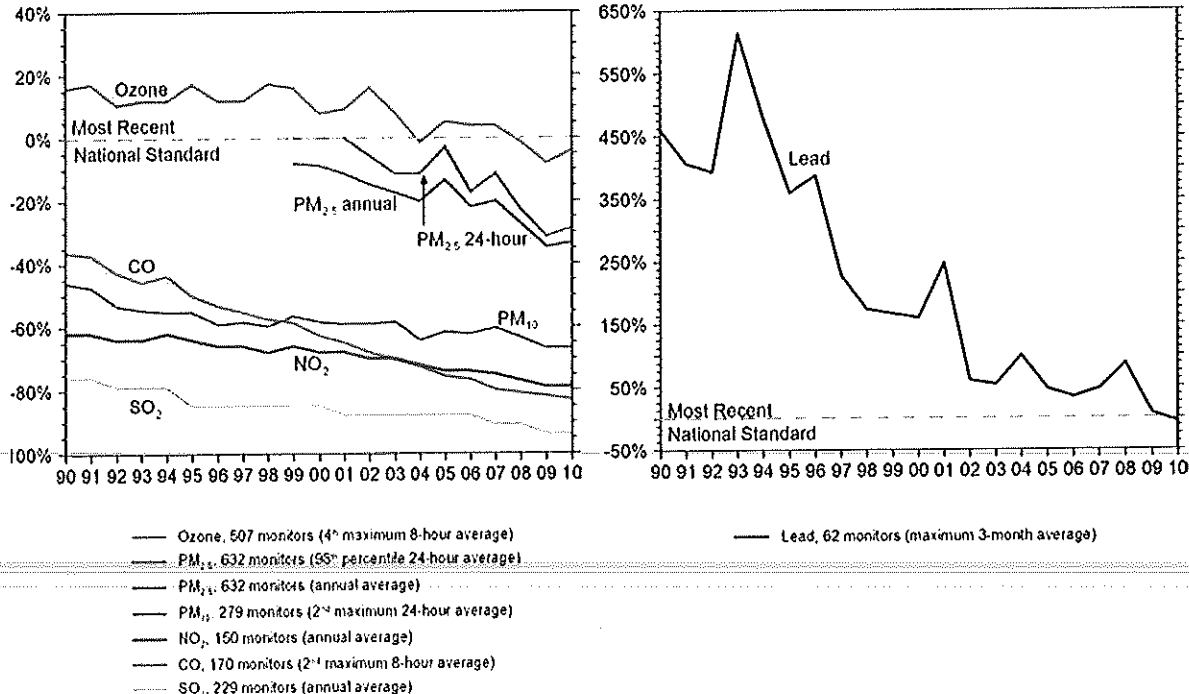
("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

- (4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO<sub>2</sub> standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

According to EPA's Air Trends report (U.S. Environmental Protection Agency, 2014b), since 1990, nationwide air quality has improved significantly for the six common air pollutants (Figure 1). These six pollutants are ground-level ozone, particle pollution [particles 2.5 micrometers in diameter and smaller (PM<sub>2.5</sub>) and particles 10 micrometers and smaller (PM<sub>10</sub>)], lead, nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), and sulfur dioxide (SO<sub>2</sub>). Nationally, air pollution was lower in 2010 than in 1990 for:

- 8-hour ozone, by 17%
- 24-hour PM<sub>10</sub>, by 38%
- 3-month average lead, by 83%
- annual NO<sub>2</sub>, by 45%
- 8-hour CO, by 73%
- annual SO<sub>2</sub>, by 75%

Figure 1. Comparison of national levels of the six common pollutants to the most recent NAAQS, 1990-2010. National levels are averages across all monitors with complete data for the time period. Note that Air quality data for PM<sub>2.5</sub> starts in 1999 (U.S. Environmental Protection Agency, 2014b).



Nationally, annual PM<sub>2.5</sub> concentrations were 24% lower in 2010 compared to 2001, and 24-hour PM<sub>2.5</sub> concentrations were 28% lower in 2010 compared to 2001. Ozone levels did not improve in much of the East until 2002, after which there was a significant decline. Eight-hour ozone concentrations were 13%

lower in 2010 than in 2001. This decline is largely due to reductions in oxides of nitrogen (NO<sub>x</sub>) emissions required by EPA rules including the NO<sub>x</sub> State Implementation Plan (SIP) Call, preliminary implementation of the Clean Air Interstate Rule (CAIR), and Tier 2 Light Duty Vehicle Emissions Standards (U.S. Environmental Protection Agency, 2014b).

The EPA concludes that total emissions of toxic air pollutants have decreased by approximately 42% between 1990 and 2005. Control programs for mobile sources and facilities such as chemical plants, dry cleaners, coke ovens, and incinerators are primarily responsible for these reductions. The EPA also found that monitored concentrations of toxic pollutants such as benzene, 1,3-butadiene, ethylbenzene, and toluene decreased by 5% or more per year between 2003 and 2010 at more than half of ambient monitoring sites. Other toxic air pollutants of concern to public health such as carbon tetrachloride, formaldehyde, and several metals, declined at most sites (U.S. Environmental Protection Agency, 2014b).

### *Visibility*

Visibility, also referred to as visual range, is a subjective measure of the distance that light or an object can clearly be seen by an observer. Light extinction is used as a measure of visibility and is calculated from the monitored components of fine particle mass (aerosols) and relative humidity. It is expressed in terms of deciviews, a measure for describing perceived changes in visibility. One deciview is defined as a change in visibility that is just perceptible to an average person, which is approximately a 10% change in light extinction. Visibility can also be defined by standard visual range (SVR) measured in miles, which is the farthest distance at which an observer can see a black object viewed against the sky above the horizon. The larger the SVR, the cleaner the air. To estimate potential visibility impairment, monitored aerosol concentrations are used to reconstruct visibility conditions for each day monitored. The aerosol species include ammonium sulfate, ammonium nitrate, organic mass, elemental carbon, soil elements, and coarse mass (Malm, 1999). The daily values are then ranked from clearest to haziest and divided into three categories; the mean visibility for all days (average), the 20% of days with the clearest visibility (20% clearest), and the 20% of days with the worst visibility (20% haziest).

A wide variety of pollutants can impact visibility, including particulate matter, nitrogen dioxide, nitrates (compounds containing NO<sub>3</sub>), and sulfates (compounds containing SO<sub>4</sub>). Fine particles suspended in the atmosphere decrease visibility by blocking, reflecting, or absorbing light.

Two types of visible impairment can be caused by emission sources: plume impairment and regional haze. Plume impairment occurs when a section of the atmosphere becomes visible due to the contrast or color difference between a discrete pollutant plume and a viewed background, such as a landscape feature. Regional haze occurs when pollutants from widespread emission sources become mixed in the atmosphere and travel long distances (Malm, 1999).

There are three classifications of areas that attain NAAQS: Class I, Class II, and Class III. Congress established certain national parks and wilderness areas as mandatory Class I areas where only a small amount of air quality degradation is allowed. Since 1980, the Interagency Monitoring of Protected Visual Environments (IMPROVE) network has measured visibility in Class I areas. These areas are



managed as high visual quality under the federal visual resource management (VRM) program. The 1977 Clean Air Act (CAA) Amendments, Section 169A declared “as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I federal areas which impairment results from manmade air pollution” (42 U.S.C. § 7491(a)(1)). All other areas of the U.S. are designated as Class II, which allow a moderate amount of air quality degradation. No areas of the U.S. have been designated Class III, which would allow more air quality degradation. The CAA gives federal managers the affirmative responsibility, but no regulatory authority, to protect air quality-related values, including visibility, from degradation.

There are no known Class I or Class II areas in Pennsylvania. The closest known class I areas are Lye Brook Wilderness Area in Vermont and Brigantine Wilderness Area in New Jersey. Based on the *Pennsylvania Department of Environmental Protection: Revision to the State Implementation Plan for Regional Haze* (2010), Mid-Atlantic/Northeast Visibility Union (MANE-VU) Contribution Assessment, emission from Pennsylvania impact visibility in the following class I areas outside MANE-VU: Dolly Sods Wilderness/Otter Creek Wilderness Areas (the Dolly Sods IMPROVE monitor is also representative of Otter Creek) in West Virginia; and Shenandoah National Park and James River Face Wilderness Areas in Virginia. The DEP has conferred with regional haze planning staff in both Virginia and West Virginia and neither of these two states intends to request that Pennsylvania make additional reduction at emissions sources located in Pennsylvania. Further modeling shows that projected contribution of any single source unit from Pennsylvania to visibility impairment at Dolly Sods Wilderness Area, Shenandoah National Park or James River Face Wilderness Area is less than 1% and that no further consultation was needed.

Prevention of Significant Deterioration (PSD) increments limit air quality degradation and ensure that areas with clean air continue to meet NAAQS, even during economic development. The PSD program goal is to maintain pristine air quality required to protect public health and welfare from air pollution effects and “to preserve, protect and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic or historic value” (U.S. Environmental Protection Agency, 2013).

PSD increments have been established for NO<sub>2</sub>, SO<sub>2</sub>, and PM<sub>10</sub>. Comparisons of potential PM<sub>10</sub>, NO<sub>2</sub>, and SO<sub>2</sub> concentrations with PSD increments are intended only to evaluate a threshold of concern. The allowable PSD increment depends on an area’s classification. Class I areas have lower increments, due to their protected status as pristine areas.

The federal PSD requirements promulgated by the EPA Administrator in 40 C.F.R. § 52 under Section 161 of the CAA, 42 U.S.C.A. § 7471, are adopted in their entirety and incorporated by reference in 25 Pa. Code § 127.83 (relating to adoption of program). The June 3, 2010, Tailoring Rule provisions codified in 40 CFR § 52.21 are automatically adopted and incorporated by reference. On August 21, 1984, DEP’s PSD program was approved by EPA as a SIP revision and codified in 40 CFR § 52.2058 (Letter from John Hanger to Shawn Garvin, 2010).

### *Atmospheric Deposition*

Atmospheric deposition refers to processes in which air pollutants are removed from the atmosphere and deposited into terrestrial and aquatic ecosystems. Air pollutants can be deposited by precipitation (rain and snow) or the gravitational settling of gaseous pollutants on soil, water, and vegetation. Much of the concern about deposition is due to secondary formation of acids and other compounds from emitted nitrogen and sulfur species, such as oxides of nitrogen ( $\text{NO}_x$ ) and  $\text{SO}_2$ , which can contribute to acidification of lakes, streams, and soils and affect other ecosystem characteristics, including nutrient cycling and biological diversity.

Substances deposited include:

- Acids, such as sulfuric ( $\text{H}_2\text{SO}_4$ ) and nitric ( $\text{HNO}_3$ ), sometimes referred to as acid rain
- Air toxics, such as pesticides, herbicides, and volatile organic compounds (VOCs)
- Heavy metals, such as mercury
- Nutrients, such as nitrates ( $\text{NO}_3^-$ ) and ammonium ( $\text{NH}_4^+$ )

The accurate measurement of atmospheric deposition is complicated by contributions to deposition by several components including but not limited to rain, snow, cloud water, particle settling, and gaseous pollutants. Deposition varies with precipitation and other meteorological variables (e.g., temperature, humidity, winds, and atmospheric stability), which in turn, vary with elevation and time.

The USFS has established guidelines for Levels of Concern (LOC) for total deposition of nitrogen and sulfur compounds in Class I Wilderness Areas. Total nitrogen deposition of 1.5 kilograms (kg) per hectare (ha) per year or less is considered unlikely to harm terrestrial or aquatic ecosystems. For total sulfur deposition, the LOC is 5 kg per ha per year. The USFS is considering a sulfur LOC of 1.5 kg per ha per year. Note that these are the same LOCs the National Park Service uses (U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, 2010).

### *Current Pollution Concentrations*

"Design Concentrations" are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS.

Air quality in a given region can be measured by its Air Quality Index (AQI) value. The AQI is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI < 50), moderate (50-100), unhealthy for sensitive groups (100-150), unhealthy (>150), very unhealthy and hazardous. The AQI is a national index, the air quality rating is an important indicator for populations sensitive to air quality changes (U.S. Environmental Protection Agency, 2014c).

According to Bradford County Air Quality data on USA.com (World Media Group, LLC., 2014) the average AQI has dropped about 10 points ( $\approx 48$  down to  $\approx 38$ ) from 1999 to 2009 within Bradford County. This trend appears to follow suit with the Pennsylvania and U.S. mean AQI during the same timeframe.

## Climate and Climate Change

### *Climate*

The Upper/Middle Susquehanna Region has a moderate climate, lacking long periods of extreme hot or cold weather with temperatures ranging from a minimum of 9-13° F to 78-83° F in a majority of the basin. Average annual precipitation in the project area ranges from 36-40 inches within the area proposed for leasing, which is generally enough to support the vast agricultural lands of the region without irrigation. Almost half of the basin's annual precipitation falls during the storms between May and September, the primary plant-growing season with the remainder falling during the winter months (Pennsylvania Department of Environmental Protection, 2014b).

### *Climate Change*

Climate change refers to any significant change in measures of climate (e.g., temperature or precipitation) lasting for an extended period (decades or longer). Climate change may result from natural processes, such as changes in the sun's intensity and natural processes within the climate system (such as changes in ocean circulation), and human activities that change the atmosphere's composition (such as burning fossil fuels) and the land surface (such as urbanization) (Intergovernmental Panel on Climate Change (IPCC), 2007).

Greenhouse gases (GHGs) are gases in the atmosphere composed of molecules that absorb and reradiate infrared electromagnetic radiation. When present in the atmosphere the gas contributes to the greenhouse effect. The greenhouse effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric GHGs and is re-radiated in all directions. Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases. Some GHGs such as CO<sub>2</sub> occur naturally and are emitted to the atmosphere through natural processes and human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. The primary GHGs that enter the atmosphere as a result of anthropogenic activities include CO<sub>2</sub>, methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Fluorinated gases are powerful GHGs that are emitted from a variety of industrial processes including production of refrigeration/cooling systems, foams and aerosols. Fluorinated gases are not primary to the activities authorized by the BLM and will not be discussed further in this document.

The Center for Climate Strategies (CCS) prepared the *Pennsylvania Greenhouse Gas Inventory and Reference Case Projection 1990-2025* for the Pennsylvania Environmental Council (Baillie, Jamison, Peterson, & Roe, 2007). This report presents initial estimates of historical and projected Pennsylvania anthropogenic GHG emissions and sinks for the period from 1990 to 2025. These estimates are intended to provide an initial comprehensive understanding of past, current and possible future Pennsylvania GHG emissions.

The inventory report discloses that activities in Pennsylvania accounted for approximately 317 million metric tons (MMt) of gross carbon dioxide equivalent (CO<sub>2</sub>e) emissions in 2005 an amount equal to 4%

of total U.S. gross GHG emissions. Gross emissions include all major sources and gases, most notably carbon dioxide emissions from combustion of fossil fuels in power plants, vehicles, buildings, and industries (89% of total State emissions), the release of methane from fossil fuel combustion, oil and gas production, coal mines, agriculture, and waste management (7%) and other sources such as industrial processes and nitrous oxide from agricultural soils (4%). Pennsylvania gross GHG emissions increased 4% from 1990 to 2005, while national emissions rose by only 16% over the same period. Annual sequestration (removal) of GHG emissions due to forestry and other land-uses in Pennsylvania are estimated at 17 MMtCO<sub>2</sub>e in 2005. This slower increase appears largely attributable to a few key factors: limited population and economic growth, a large decrease in coal consumption in industry due to a decrease in steel production, and increased capture of methane from landfills. Pennsylvania's per capita emission rate is approximately the same GHG emissions as the national average of approximately 25 MtCO<sub>2</sub>e/yr. Like the nation as a whole, per capita emissions have remained fairly flat. Economic growth outpaced emissions growth throughout the 1990-2005 period both nationally and in Pennsylvania. During this time, gross GHG emissions per unit of gross product dropped by almost 40 percent nationally, and by 26 percent in Pennsylvania.

Ongoing scientific research has identified the potential impacts of anthropogenic GHG emissions and changes in biological sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO<sub>2</sub>e concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The IPCC (2007) concluded that "warming of the climate system is unequivocal" and "most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations".

It is important to note that GHGs will have a sustained climatic impact over different temporal scales. For example, recent emissions of CO<sub>2</sub> can influence climate for 100 years. In contrast, black carbon is a relatively short-lived pollutant, as it remains in the atmosphere for only about a week. It is estimated that black carbon is the second greatest contributor to global climate change behind CO<sub>2</sub> (Ramanathan & Carmichael, 2008). Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (National Aeronautics and Space Administration, 2007). In 2001, the IPCC (2007) indicated that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The National Academy of Sciences (Hansen et al., 2006) has confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions. Observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Data indicates that northern latitudes (above 24° N) have exhibited temperature increases of nearly 1.2°C (2.1°F) since 1900, with nearly a 1.0°C (1.8°F) increase since 1970 alone. It also shows

temperature and precipitation trends for the conterminous United States. For both parameters, there are varying rates of change, but overall increases in both temperature and precipitation.

The lack of scientific tools designed to predict climate change at regional or local scales limits the ability to quantify potential future impacts. However, potential impacts to air quality due to climate change are likely to be varied. Oil and gas development activities can generate CO<sub>2</sub> and CH<sub>4</sub>. CO<sub>2</sub> emissions result from the use of combustion engines, while CH<sub>4</sub> can be released during processing.

Because GHGs circulate freely throughout Earth's atmosphere, the planning area for this resource is the entire globe. The largest component of global anthropogenic GHG emissions is CO<sub>2</sub>. Global anthropogenic carbon emissions reached about 7,000,000,000 metric tons per year in 2000 and about 9,000,000,000 metric tons per year in 2008 (Boden, et al, 2010). Oil and gas production is a major contributor of GHGs. In 2006, natural gas production accounted for 8% of global methane emissions, and oil production accounted for 0.5% of global methane emissions (URS Corporation, 2010). A description of the potential GHG emissions associated with the proposed leasing activities is included in Chapter 4.

### Noise and Odor

The area proposed for leasing occurs in an area with rolling wooded hills managed for wildlife and particularly game species. From aerial imagery a few areas are managed for timber and/or agriculture use. There exists habitat such as the yellow-bellied flycatcher (*Empidonax flaviventris*), the northern long-eared bat (*Myotis septentrionalis*), and the Indiana bat (*Myotis sodalis*) that may be sensitive to sound during certain times of the year.

### Environmental Justice

Executive Order 12898 (1994) formally requires Federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs agencies to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority or low-income populations.

Lands within the decision area are located in a rural area and used primarily for hunting, fishing, and trapping. The proposed action will not create disproportionately high and adverse human health or environmental effects on minority populations and low-income populations, including tribal populations. No further analysis is warranted for Environmental Justice factors on this project.

### Fish and Wildlife

The Decision area supports various game and non-game mammals, herptiles, birds, and other wildlife taxa. Most of the Decision area is covered in second-growth, upland timber, pine plantations, and open croplands, as detailed in **Vegetation**, below. Whitetail deer are abundant in the decision area, and the PGC has erected several deer exclosures for the purpose of allowing trees to regenerate in the absence of deer herbivory (Figure 2). Threatened and endangered species and migratory birds will be discussed in their own sections within this chapter.

### *Special-Status Species*

The U.S. Fish and Wildlife Service, Pennsylvania Field Office encourages project proponents to conduct automated project reviews using the Pennsylvania Natural Heritage Program (PNHP) online PNDI Environmental Review Tool (Pennsylvania Natural Heritage Program, 2014). The BLM conducted a review of the project on August 6, 2013, using the Decision area as the project boundary.

The decision area is within the known historic range of the federally endangered Indiana bat (*Myotis sodalis*) (U.S. Fish and Wildlife Service, 2013), but the PGC reports, as of 2010, that the nearest summertime live-captures of Indiana bats in Pennsylvania were in Berks and McKean Counties, both more than 80 miles from the Decision area (Pennsylvania Game Commission, 2010). The nearest known hibernacula are in Luzerne County, Pennsylvania, at least 35 miles away, and in Onondaga County, New York, about 50 miles to the north. This bat species utilizes upland woods and riparian corridors, which are found throughout the decision area.

The yellow-bellied flycatcher (*Empidonax flaviventris*) has been reported in Corbin Creek Wetlands and is listed as a Federal Migratory Bird of Conservation Concern and by the state as a state-endangered species. Corbin Creek is listed as an important site in the Pennsylvania Natural Heritage Inventory (Pennsylvania Department of Conservation and Natural Resources, 2013a).

Mist net surveys from 2011 indicate presence of northern long-eared bats (*Myotis septentrionalis*), a Pennsylvania mammal species of concern that has been proposed to be listed as endangered under the Endangered Species Act. This species of bat utilizes upland woods and riparian corridors, which are found throughout the decision area.

According to the PNHP website (2014), there exist various state listed rare, threatened, or endangered species within Bradford County. However, a project specific review conducted through the PNDI Environmental Review Tool on the PNHP website (2014) did not show any state species of concern within the area proposed for leasing.

### **Geology/Mineral Resources/Energy Production**

The decision area is situated within the east-central portion of the central Appalachian Basin, an arcuate sedimentary basin elongated from western New England southwest to Ohio, West Virginia and northeastern Kentucky. The sediments reach depths over 15,000 feet in Berks County, southeastern Pennsylvania. Beneath the sedimentary section are crystalline basement rocks of the metamorphic Grenville Province. The sediments range in age from Cambrian, exposed in the southern part of the state, to Permian in the southwest. Bedrock underlying much of SGL 219 consists of the Devonian Lock Haven and Catskill Formations; made up of sandstone, siltstone, claystone, shale, and thin conglomerates.

Structure in the area consists of bedrock dipping southerly toward the basin axis. Superimposed on this is an east-trending syncline with an axis that passes just south of the property. The deep structure is still not well understood, but some models indicate deep transverse faulting in the region (Wickstrom, Perry, Riley, et al., 2006). One fault in this network appears just west of the property. The recent focus on

natural gas exploration in the region has added a great deal of drillhole and seismic data, allowing more detailed analysis of the deep geologic structure.

Before 2005, the only significant mineral development in Bradford County consisted of limited coal mining, scattered sand and gravel operations and limestone and dimension sandstone ("bluestone") quarries. Coalbed methane and an Oriskany natural gas pool, the Stagecoach Field, had been the only hydrocarbons produced in the county, and exploration activity was low. The Marcellus Shale had long been known to contain natural gas, but the volumes from vertical shale wells were not sufficient to justify infrastructure investment.

In 2005, Range Resources drilled and completed the first horizontal Marcellus well in Washington County, southwestern Pennsylvania. The well was kicked off a vertical Marcellus well, the Renz #1, which had been completed at about 300 thousand cubic feet of gas per day (Mcf/d). The first horizontal leg (lateral) of the well, modeled after completions in the Barnett Shale in the Fort Worth basin, Texas, tested at 4000 Mcf/d. The announcement of the results created a leasing boom in the state which continues to the present.

The rate of new well starts in the Marcellus shale has slowed. Many of the wells already drilled await pipeline connections, and the current wellhead price of *dry* gas – nearly pure methane with no natural gas liquids (NGL) – is low and predicted to remain below \$5.00/Mcf until the economy adjusts its energy source profile to expand the use of natural gas in power generation and vehicle fuels. Efforts are also underway to increase exports of liquid natural gas (LNG).

### Hazardous Wastes

The Resource Conservation and Recovery Act (RCRA) of 1976 established a comprehensive program for managing hazardous wastes from the time they are produced until their disposal. The EPA regulations define solid wastes as any "discarded materials" subject to a number of exclusions. On January 6, 1988, EPA determined that oil and gas exploration, development and production wastes would not be regulated as hazardous wastes under the RCRA. The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, deals with the release (spillage, leaking dumping, accumulation, etc.), or threat of a release of hazardous substances into the environment. Despite many oil and gas constituent wastes being exempt from hazardous waste regulations, certain RCRA exempt contaminants could be subject to regulations as a hazardous substance under CERCLA.

The decision area contains no commercial or captive hazardous waste sites. One land recycling cleanup location, labeled the Reagan Hill Road Release, is located near the west end of the SGL 219 and has the client listed as Talisman Energy USA, Inc. The site is listed as *inactive*. Should a parcel be leased and developed, generation and temporary storage of waste materials (solid and liquid) would likely occur. Waste materials would be managed in accordance with Onshore Orders 1 & 7, RCRA, applicable Pennsylvania DEP rules and regulations. Fluid handling would be evaluated at the development stage and fluids associated with any subsequent drilling, completions and/or production would either be treated, evaporated, or transferred to an approved Pennsylvania DEP treatment facility. Solid wastes would be treated on site or transferred to a Pennsylvania DEP approved facility.

## Cultural Resources

A cultural resource is a location of human activity, occupation, or use identifiable through field inventory, historical documentation, or oral evidence. Cultural resources include both historic and prehistoric archaeological sites, structures, places of architectural significance, locations with important public and scientific uses, and may include traditional cultural properties, which are definite locations of traditional and or cultural importance to specific social and or cultural groups. Cultural resources include but are not limited to the following types: prehistoric archaeological resource, ethnographic resource, and historic-period archaeological and built environment resources. Cultural resources may be, but are not necessarily eligible, for the National Register of Historic Places (NRHP).

A records search of the Pennsylvania Bureau of Historic Places Cultural Resources GIS (PBHP-CRGIS) Database on March 31, 2014, showed no previously recorded cultural resources within or adjacent to the decision area.

## Recreation

SGL 219 is set aside for hunting, with game animals including deer and dove. There is a single developed trail, 1.5 miles in length, between Montrose Turnpike to Dewing Road. SGL 219 has 49 designated parking areas for access. Dirt roads throughout the decision area may be used for off-highway vehicle use, an activity expected to increase during hunting season. Some forms of recreation occur on the private property parcels that are scattered throughout the decision area; most would be similar to those which take place on SGL 219, although there is no specific data available.

## Socioeconomics

Bradford County is located in the northern part of Pennsylvania, bordered on the west by Tioga and Lycoming Counties, to the north by the state of New York, by Susquehanna and Wyoming Counties to the east, and Sullivan County to the south. Bradford County is 1,147.40 square miles, with a population density of approximately 55 persons per square mile. Its estimated population in 2012 was 62,792, a 0.3% increase from the 2010 census. The county seat is located in the borough of Towanda, in the central part of the county. The project area encompasses approximately 5,200 acres and a 7,500-foot buffer around SGL 219, a total of 20,500 acres.

The distribution of population in Bradford County is 96.3% White, 1.3% Hispanic or Latino, 1.1% Two or More Races, 0.6% African American, 0.6% Asian, and 0.3% Native American or Alaska Native. 77.7% of Bradford County residents are 18 years of age or older, with 18.5% aged 65 years or older; the state of Pennsylvania has a population 18 years of age and older of 78.5%, with 16% aged 65 or older.

In 2011, there were 30,009 housing units in the county with a homeownership rate from 2007-2011 of 75.2%, which is about 5% higher than the state as a whole. The median value of these owner-occupied homes was \$108,600 for the period 2007-2011, much lower than that of the state.

For the period 2007-2011, median household income was \$42,433 for Bradford County, over \$9,200 lower than for the state. Approximately 13.6% of persons lived below the poverty level, one percent higher than the 12.6% statewide that live below the poverty level. In 2011, 38.2% of Bradford County



households received some form of Social Security payment, 22.6% of households received retirement income, and 10.3% of households received benefits from the Supplemental Nutrition Assistance Program (SNAP); the totals for social security income and retirement income are much higher than the national averages for these respective categories, while SNAP payments are virtually the same as national averages (U.S. Department of Commerce, 2012a). 85.5% of the county population 25 years of age and over graduated from high school, about two percent lower than the state. 16.5% of county residents 25 years of age and older have a bachelor's degree compared to 26.7% for Pennsylvania as a whole. About 3% of residents speak a foreign language in the home; in total, about 10% of Pennsylvania residents speak a foreign language in the home (U.S. Department of Commerce, 2013b).

The seasonal unemployment rate for Bradford County was 6.8% in May 2013, a 0.8% increase from the 6% rate in May 2012 but 0.8% lower than Pennsylvania's seasonally adjusted unemployment rate of 7.6% for May 2013 (U.S. Department of Labor, 2013).

In 2011, the health care and social assistance sector employed the most people (employment totals include wage and salary jobs and proprietors) in Bradford County (5,280) followed by manufacturing (4,530); retail trade (3,957); and government (3,452). The mining sector gained the most wage and salary jobs and proprietors in the county between 2001 and 2011 (+1,606, an increase of 431.7% during the period), followed by transportation and warehousing (+476); construction (+456); and health care and social assistance (+421). Manufacturing (-2,195) and the farming (-575) sectors lost the most wage and salary jobs and proprietors during this period (U.S. Department of Commerce, 2012a).

According to the Department of Commerce (2013), from 1998 to 2011, mining employment in Bradford County grew from 51 jobs in 1998 to 627 jobs in 2011, a 1,129.4% increase. Mining dependent employment also grew during this period from four to 48 jobs, a 1,100% increase. Most of these jobs directly involve oil and gas extraction, which is about 3% of the county's employment. In total, mining jobs account for about 5.5% of the county's employment. Average annual wages in 2012 for mining jobs in Bradford County were \$82,675 (U.S. Department of Labor, 2012).

Hunting is a major part of life in Pennsylvania. The state boasts nearly one million hunters, 18.2 million days of hunting per year, supports over 15,000 jobs, and generates approximately \$529 million in salaries/wages. Hunters spend \$986 million per year, with the average hunter spending around \$1260 per year. This spending generates \$121 million in state and local taxes per year. Hunters pay more than \$136 million in federal taxes per year (U.S. Fish and Wildlife Service, 2012; Congressional Sportsmen's Foundation, 2012).

Demographically, Bradford County is less affluent, less educated, much more homogenous and older than most counties in the state of Pennsylvania. The main factor that may be influencing this demographic profile is the number of retirees living in the county based on the preponderance of Social Security and retirement incomes.

## Soils

The Decision area is in the glaciated portion of Pennsylvania, and many of the soil types are rocky and characterized by steep slopes. The dominant soil types range from very poor to fair for agricultural

production and from slight to moderate for mixed hardwood forest production. Six hundred, sixty-four acres (five percent) of the decision area is classified as *prime farmlands*, and 9,700 acres (68 percent) is classified as *farmlands of statewide importance* (U.S. Department of Agriculture, 2014). Most of the areas not classified as important farmlands are steep slopes, very rocky soils, or wetlands (See **Water Resources and Wetlands**).

## Vegetation

The SGL 219 area is mostly forested, with just over 300 acres in sharecropping agreements and a few other small openings planted as wildlife food plots. About half of the adjacent private lands within the Decision area are forested, and the remnant consists mostly of pastures and croplands. The most common forest type in SGL 219 is northern hardwood forests in the 40-80 year age class. SGL 219 includes several other forest types and a significant component of forest in the 81-125 year age class. SGL 219 also contains many areas with undesirable vegetation communities, including American beech, black birch, striped maple, hay-scented fern, and the exotic, invasive species described in **Invasive Species/Noxious Weeds**. The SGL 219 contain 165 acres of deer exclosures erected to allow regenerating forest to mature in the absence of deer herbivory.

### *Special-Status Species*

The soft-leaved sedge (*Carex disperma*) – a state-special-concern plant species that lives in cool, wooded wetlands is known to occur in Corbin Creek Wetlands, a complex in the southeastern portion of the decision area, just outside of the state game lands.

There are various other state species listed as rare, threatened or endangered species within Bradford County. However, a project specific review conducted through the PNDI Environmental Review on the PNHP website (2014) only showed soft-leaved sedge (*Carex disperma*) to occur within the area proposed for leasing.

### *Invasive Species/Noxious Weeds*

Many invasive species are present in, around the Decision area, and throughout Pennsylvania. A list of invasive plant species identified as problems in Pennsylvania can be found on the Pennsylvania Department of Conservation and Natural Resources website (Pennsylvania Department of Conservation and Natural Resources, 2014). Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), and Oriental bittersweet (*Celastrus orbiculatus*) are the species that pose the greatest concern to the managers of SGL 219. These species are present in disturbed areas and are readily propagated along roads and other openings. Emerald ash borer (*Agilus planipennis*), an insect that has destroyed millions of ash trees throughout the Midwest, has been identified in three of the five adjacent Pennsylvania counties. There is a small population of feral swine on SGL 219 and, most likely, the adjacent private lands.

## Visual Resources

Most of the Decision area is hilly, forested, and rural, with a significant portion in agricultural use. Several oil and gas well pads have been constructed in the decision area. A 30-foot wide, high-tension power line runs through the decision area, including 4,000 feet of length within the state game lands,

and residential electric lines run along the roads. A 50-foot pipeline right-of-way runs through the decision area, including over 4,000 feet of length within the SGL 219.

### **Water Resources, Surface/Ground**

The Pennsylvania DEP Office of Oil and Gas Management (OOGM) regulates oil and gas operations in Pennsylvania. The PA DEP OOGM has the responsibility to gather oil and gas production data, permit new wells, establish pool rules and oil and gas allowables, issue discharge permits, enforce rules and regulations of the division, monitor underground injection wells, and ensure that abandoned wells are properly plugged and the land is responsibly restored. The Pennsylvania DEP administers the major environmental protection laws. The Pennsylvania DEP Office of Water Management Plans (OWMP), which is administratively attached to the state, assigns responsibility for administering its regulations to constituent agencies, including the OOGM.

#### *Surface Water Resources*

Surface water hydrology within the area is typically influenced by geology, soil characteristics, precipitation and vegetation. The decision area contains 74 miles of streams, most of which are first- or second-order streams, including Corbin Creek, Dewey Creek, Prince Hollow Run, and Wappesening Creek. About two miles of Prince Hollow Run has impaired aquatic habitat due to nutrient overloading from animal feedlots. Most of the creeks in the decision area are small with steep banks and have minimal floodplains. The National Wetlands Inventory (U.S. Fish and Wildlife Service, 2014) shows 206 acres of wetlands within the decision area. All of these are smaller than 13 acres, and about half of them are smaller than two acres. Almost all of these wetlands are associated with creeks. The project falls within the Upper/Middle Susquehanna River Basin, which is the 16th largest river in the country, draining nearly 18,295 sq miles. The Upper/Middle Susquehanna region and its headwaters are located in some of the largest, most densely populated forested areas in the state, which are important to water quality (Pennsylvania Department of Environmental Protection, 2014b). Many impaired waters exist within the Upper/Middle Susquehanna Region. DEP supports local watershed groups, conservation districts and municipalities in developing Watershed Implementation Plans, which identify pollution sources in these areas and recommend best management practices (BMPs) for cleaning them up. These plans are submitted to the EPA to provide a "road map" for future stream restoration efforts and funding. Currently within the Upper/Middle Susquehanna Region, five Watershed Implementation Plans have been completed (Pennsylvania Department of Environmental Protection, 2014c).

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Water resources may be affected by many activities including fire/prescribed burns, military use, mineral extraction, recreation, transportation, and vegetation management activities. The most likely effects to hydrology will be to stream channel morphology, and water quality. Channel alterations can be measured in specific morphological parameters. Water nutrients can be measured in concentration per unit volume.

#### *Ground Water Resources*

Groundwater hydrology within the area is influenced by geology and recharge rates. Groundwater quality and quantity can be influenced by precipitation, water supply wells, and various disposal activities.

Groundwater in and around SGL 219 comes from the upper/middle Susquehanna River Basin within interbedded sedimentary geology and average annual precipitation between 36 and 40 inches according to the *Pennsylvania Water Atlas* (2014b). Normal rainfall amounts are generally enough to support the vast agricultural lands of the region without irrigation. Almost half of the basin's annual precipitation falls during storms between May and September, the primary plant-growing season. The remainder precipitation, including snowmelt during the winter months infiltrates the ground and recharges groundwater reserves (Pennsylvania Department of Environmental Protection, 2014b).

The decision area likely contains approximately 100 drinking water wells, based on a review of data available online through the Pennsylvania Groundwater Information System (Pennsylvania Department of Conservation and Natural Resources, 2013b).

Most onshore produced water is injected deep underground for either enhanced recovery or disposal. With the passage of the Safe Drinking Water Act in 1974, the subsurface injection of fluids came under federal regulation. In 1980, the EPA promulgated the Underground Injection Control regulations. The program is designed to protect underground sources of drinking water.

#### *Hydraulic Fracturing*

Hydraulic fracturing began in the 1940s, but was not utilized on a large scale until the around 2000, when technologies improved and energy companies began utilizing the process more regularly to improve production. Based on current trends, it is likely that these wells would be fracked at multiple points along the horizontal leg of a multilateral wellbore within the production zone. Horizontal legs in the area are reaching on average 5,000 feet through the formation at an average depth of approximately 10,900 feet. On average, approximately 3-6 million gallons (~71,400~142,900 bbl.) are being used in Bradford County to frack wells. The predominant source of potable groundwater has a maximum depth below 700 feet (Pennsylvania Department of Conservation and Natural Resources, 2001), meaning that the potable groundwater is separated from the production zone by a distance on the order of approximately 10,000 feet on average.

Of the millions of gallons of water used to hydraulically fracture a well one time, less than 30% to more than 70% may remain underground (Bamberger & Oswald, 2012). Used fracturing fluids that return to the surface are often referred to as "flowback". The resulting flowback and produced water will be contained until it is promptly removed and disposed of to an injection well, recycling facility, or disposal facility. Conditions of Approval (COAs) at the APD stage will require the operator and contractors to ensure that all use, production, storage, transportation and disposal of produced water associated with the drilling, completion and production of a well be in accordance with all applicable existing or hereafter promulgated Federal, state and local government rules, regulations and guidelines.

## CHAPTER 4 – ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

### Introduction

This chapter assesses potential consequences associated with direct, indirect, and cumulative effects of the Proposed Action. The No-Action Alternative, which would be to withhold the Federal minerals from leasing, would have no impacts on resources.

### Air Resources

#### *Air Quality*

The administrative act of offering any of the proposed parcels and the subsequent issuing of leases would have no direct impacts to air quality. Any potential effects to air quality would occur if, and when, the leases were developed. Any proposed development project would be subject to additional analysis of possible air effects before approval. The analysis may include air quality modeling for the activity. Over the last ten years, the development of the Federal oil and gas mineral estate within the twenty-state jurisdiction of the NSFO has resulted in an average of one to two wells being spudded annually. These wells would incrementally contribute a small percentage of total emissions (including GHGs) from oil and gas activities.

A Memorandum of Understanding (MOU) between the Departments of the Interior, Agriculture, and EPA (U.S. Department of Agriculture, U.S. Department of Interior, & U.S. Environmental Protection Agency, 2011) directs that air quality modeling be conducted for actions that meet certain emissions or geographic criteria:

- Creation of a substantial increase in emissions
- Material contribution to potential adverse cumulative air quality impacts
- Class I or sensitive Class II Areas
- Non-attainment or maintenance area
- Area expected to exceed NAAQS or PSD increment

The proposed project area includes no Class I, sensitive Class II or non-attainment areas. Due to the small number of wells projected to follow a lease on the proposed tracts in relation to the current volume of hydrocarbons, development of the lease is not likely to exceed the emissions criteria, NAAQS or PSD increment, or contribute to adverse cumulative air quality impacts. As a result, air quality modeling is not required for the proposed project and likely will not be required at the APD stage if development occurs as a result of the proposed lease.

The following sources of emissions are anticipated during any oil and gas exploration or development: combustion engines (i.e. fossil fuel fired internal combustion engines used to supply electrical or hydraulic power for hydraulic fracturing to drive the pumps and rigs used to drill the well, drill out the hydraulic stage plugs and run the production tubing in the well; generators to power drill rigs, pumps, and other equipment; compressors used to increase the pressure of the oil or gas for transport and use;

and tailpipe emissions from vehicles transporting equipment to the site), venting (i.e. fuel storage tanks vents and pressure control equipment), mobile emissions (i.e. vehicles bringing equipment, personnel, or supplies to the location) and fugitive sources (i.e. pneumatic valves, tank leaks, and dust). A number of pollutants associated with combustion of fossil fuels are anticipated to be released during drilling including: CO, NO<sub>x</sub>, SO<sub>2</sub>, Pb, PM, CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O. Venting may release VOC/HAP, H<sub>2</sub>S, and CH<sub>4</sub>. Mobile source emissions are likely to include fugitive particulate matter from dust or inordinate idling.

The actual emissions of each pollutant will be entirely dependent on the factors described in the previous paragraph. During the completion phase, the most significant emissions of criteria pollutants emitted by oil and gas operations in general are VOCs, particulate matter and NO<sub>2</sub>. VOCs and NO<sub>x</sub> contribute to the formation of ozone. The EPA's Natural Gas STAR Program (2014e) is a voluntary program that identifies sources of fugitive methane sources and seeks to minimize fugitive CH<sub>4</sub> through careful tuning of existing equipment and technology upgrades. Data provided by STAR show that some of the largest air emissions in the natural gas industry occur as natural gas wells that have been fractured and are being prepared for production. During well completion, flowback, fracturing fluids, water, and reservoir gas come to the surface at high velocity and volume. This mixture includes a high volume of VOCs and CH<sub>4</sub>, along with air toxins such as benzene, ethylbenzene, and n-hexane. The typical flowback process lasts from three to 10 days. Pollution is also emitted from other processes and equipment during production and transportation of the oil and gas from the well to a processing facility.

To reasonably quantify emissions associated with well exploration and production activities, certain types of information are needed. Such information includes a combination of activity data such as:

- The number, type, and duration of equipment needed to construct/reclaim, drill and complete (e.g. belly scrapers, rig, completions, supply trucks, compressor, and production facilities)
- The technologies which may be employed by a given company for drilling any new wells to reduce emissions (e.g. urea towers on diesel powered drill rigs, green completions, and multi-stage flares)
- Area of disturbance for each type of activity (e.g. roads, pads, pipelines, electrical lines, and compressor station)
- Compression per well (sales and field booster), or average horsepower for each type of compressor
- The number and type of facilities utilized for production.

The degree of impact will also vary according to the characteristics of the geological formations from which production occurs. Currently, it is not feasible to directly quantify emissions. It is assumed that emissions associated with oil and gas exploration and production would incrementally contribute to increases in air quality emissions into the atmosphere.

Air pollution can affect public health in many ways. Numerous scientific studies have linked air pollution to a variety of health problems including: (1) aggravation of respiratory and cardiovascular disease, (2) decreased lung function, (3) increased frequency and severity of respiratory symptoms such as difficulty breathing and coughing, (4) increased susceptibility to respiratory infections, (5) effects on the nervous

system, including the brain, such as IQ loss and impacts on learning, memory, and behavior, (6) cancer, and (7) premature death. Some sensitive individuals appear to be at greater risk for air pollution-related health effects, for example, those with pre-existing heart and lung diseases (e.g., heart failure/ischemic heart disease, asthma, emphysema, and chronic bronchitis), diabetics, older adults, and children.

Significant degradation of air quality may also damage ecosystem resources. For example, ozone can damage vegetation, adversely affecting the growth of plants and trees. These impacts can reduce the ability of plants to uptake CO<sub>2</sub> from the atmosphere and can then indirectly affect the larger ecosystems.

### ***Mitigation***

In October 2012, EPA promulgated air quality regulations for completion of hydraulically fractured gas wells (U.S. Environmental Protection Agency, 2012). These rules require air pollution mitigation measures that reduce the emissions of VOCs during gas well completions. The BLM encourages industry to incorporate and implement proven, cost-effective BMPs designed to improve operational efficiency and cut impacts to air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include:

- Flared hydrocarbon gases at high temperatures in order to reduce emissions of incomplete combustion
- Watering dirt roads during periods of high use to reduce fugitive dust emissions
- Co-location wells and production facilities to reduce new surface disturbance
- Implementation of directional drilling and horizontal completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores
- Requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored
- Performing interim reclamation to reclaim areas of the pad not required for production facilities and to reduce the amount of dust from the pads

Another potential mitigation measure is the process known as “Green Completion” in which natural gas brought up during flowback is recaptured and rerouted into the gathering line.

### ***Visibility***

The EPA-approved *Pennsylvania Regional Haze Plan* (2010) shows through modeling, on average, emissions decreasing across the board from the base year of 2002 to the modeled year of 2018 for the six greenhouse gasses associated with NAAQS. These modeled emissions take activity and emissions growth and/or controls from 2002 into account.

### ***Climate and Climate Change***

The administrative act of leasing all or part of the two parcels in Pennsylvania SGL 219 covering 5,194 acres would not result in any direct GHG emissions. However, regarding future development, the assessment of GHG emissions and climate change is in its formative phase. While it is not possible to accurately quantify potential GHG emissions in the affected area by making the proposed tracts

available for lease, offering the proposed parcels may contribute to the installation and production of new wells, which may consequently lead to an increase in GHG emissions.

The *Pennsylvania GHG Inventory and Reference Case Projections 1990-2025* (Baillie, et al., 2007) predict a 21 percent growth in greenhouse gases ( $\approx 383 \text{ MMtCO}_2\text{e}$ ) from 2005 to 2025. These increases are slightly greater than growth from 1990 to 2005, and are driven largely by projected increases in transportation activity and electric generation. Large decreases in GHG emissions from the industrial sector such as what occurred between 1990 and 2000, are not projected in the reference case. Pennsylvania's Department of Environmental Protection (2014c) states in a memo that:

- Pennsylvania's GHG emissions are expected to be lower in 2020 than in 2000 with reductions in residential, commercial, transportation, agriculture and waste sectors.
- Carbon dioxide emissions from the fossil fuel-fired electric generating fleet in Pennsylvania has declined by 12 percent from 2008 through 2013 and is projected to decline by 29 percent from 2005 – 2020.
- Since 2008, cumulative air contaminant emissions across the state have continued to decline. In particular, sulfur dioxide emissions from electric generating units (EGU) have been reduced by approximately 70 percent. The emissions of nitrogen oxides and particulate matter have also been reduced by approximately 23 percent and 46 percent, respectively, from this sector. These reductions represent between \$14 billion and \$37 billion of annual public health benefit, based on U.S. EPA methodologies.
- Other notable reductions in Pennsylvania include:
  - Sulfur oxide emissions have gone down 70 percent since 2008.
  - Mercury, a hazardous air pollutant, emissions have gone down 37 percent since 2008.
  - Carbon monoxide emissions have gone down 16 percent since 2008.

Emissions from fossil fuel production decreased from 1990 to 2005 and are projected to level off from 2005 to 2025. The fossil fuel industry contributed approximately 6% of the total  $\text{CO}_2$  and  $\text{CH}_4$  state emissions in 2005 (Baillie, et al., 2007). However, a significant portion of the emissions attributed to the natural gas industry are due to vented gas from processing plants, many of which are used for injection in enhanced oil recovery operations. Additionally, many technological advances in emission control technology have been implemented by the oil and gas industry to reduce emission levels.

Many aspects of oil and gas production emit greenhouse gases (GHG). The primary aspects include the following:

- Fossil fuel combustion for construction and operation of oil and gas facilities – vehicles driving to and from production sites, engines that drive drill rigs, etc. These produce  $\text{CO}_2$  in quantities that vary depending on the age, types, and conditions of the equipment as well as the targeted formation, locations of wells with respect to processing facilities and pipelines, and other site-specific factors.
- Fugitive  $\text{CH}_4$  –  $\text{CH}_4$  that escapes from wells (both gas and oil), oil storage, and various types of processing equipment. This is a major source of global  $\text{CH}_4$  emissions. These emissions have



been estimated for various aspects of the energy sector, and since 2011, producers are required under 40 C.F.R. §98, to estimate and report their CH<sub>4</sub> emissions to the EPA.

- Combustion of produced oil and gas – it is expected that drilling will produce marketable quantities of oil and/or gas. Most of these products will be used for energy, and the combustion of the oil and/or gas would release CO<sub>2</sub> into the atmosphere. Fossil fuel combustion is the largest source of global CO<sub>2</sub>.

The assessment of GHG emissions, their relationship to global climatic patterns, and the resulting impacts is an ongoing scientific process. It is currently not feasible to know with certainty the net impacts from the proposed action on climate – that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. The BLM does not have the ability to associate a BLM action's contribution to climate change with impacts in any particular area. The science to be able to do so is not yet available. The inconsistency in results of scientific models designed to predict climate change on regional or local scales, limits the ability to quantify potential future impacts of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing science. When further information on the impact to climate change is known this information would be incorporated in the BLM's planning and NEPA documents as appropriate.

In recent years, many states and other organizations have initiated GHG inventories, tallying GHG emissions by economic sector. The EPA provides links to statewide GHG emissions inventories (U.S. Environmental Protection Agency, 2014d). Guidelines for estimating project-specific GHG emissions are available (URS Corporation, 2010), but some necessary data, including the volume of oil produced and the number of wells, are not available for the proposed action. The uncertainties regarding numbers of wells and other factors make it very impractical to attempt to project amounts of GHG that the proposed action would emit. At the APD stage, more site-specific information on GHG impacts and mitigation measures would be described in detail and the BLM would encourage operators to participate in the voluntary STAR program.

### Noise and Odor

While the act of leasing will not be impacted, subsequent drilling actions may negatively impact the yellow-bellied flycatcher (*Empidonax flaviventris*) and the northern long-eared bat (*Myotis septentrionalis*) that exist in the area. The Indiana bat (*Myotis sodalis*) historically resided in the area, but is no longer present in the decision area. Other wildlife may also be impacted by the noise related to these subsequent activities. Odors would occur from oil and gas development activities, but not significant enough to expect displacement of wildlife.

The actual impacts from noise are dependent on a variety of factors not known at the leasing stage, such as the type and number of engines, motors, trucks, heavy machinery, pumps, generators, production facilities, drill rig, and completion operations that will be utilized for each operation, and if baffles or mufflers or sound barriers will be utilized to minimize impacts from the noise produced.

Lease stipulations will be utilized to protect habitat for the above listed species. Use of the surrounding landscape can be utilized to mitigate the impacts of noise. Unless placed on the top of a hill, sounds are not likely to travel very far and the surrounding woodland vegetation is likely to provide a natural sound barrier to many of the sounds associated to subsequent actions resulting from leasing. If a pad is proposed in an area deemed sensitive to noise, it is the BLM's recommendation that BMPs utilizing mufflers/baffles and/or sound barriers to lessen the impacts if the pad cannot be moved.

### **Fish and Wildlife**

The proposed action would likely result in the conversion of approximately 40 acres of habitat to hardened, cleared surface during construction and drilling activities. If pads and new corridors are placed in forest interior areas, then those clearings will result in forest/habitat segmentation. Construction of pads and associated roads, pipelines and other utility corridors would create forest edge habitat, which can support opportunistic wildlife species and is less suitable for highly conservative wildlife species that require large blocks of unbroken forest.

According to the 2012 *Comprehensive Management Plan for Pennsylvania State Game Lands 219* (CMP SGL 219), SGL 219 is being managed for mixed successional habitat to improve habitat for early successional dependent species. Improving habitat on cropland portions of SGL 219 to benefit small game species and improve farmland wildlife habitat is a major focus. The Forest management objective will focus on diversifying the age class distribution and creating permanent early succession using even-aged management techniques. The CMP SGL 219 states that even-aged management would create a variety of forest age classes and improve habitat.

BLM would recommend to the PGC at the notice of staking or APD stage that, upon the wells being placed into production, areas of the well pad, roads and all of the pipeline and utility corridor unnecessary for maintaining production be placed into interim reclamation, which would signal a significant reduction in activities on the location, further reducing impacts to wildlife. Successful interim reclamation would replace wildlife habitat lost due to natural gas development until the end of the production life of the well(s) when the pad(s) will be placed into final reclamation. Interim and final reclamation would also create a variable-aged vegetative stand, which would attract wildlife and increase species diversity and/or richness in the project area.

The BLM will work with the PGC and the applicant for permits to drill to identify potential drilling locations to best minimize impacts to wildlife. As discussed in the **Ground Water** section of this chapter, proposed water withdrawals for gas development are permitted by the SRBC, which evaluates proposed withdrawals based upon their potential to reduce streamflows to levels that would be detrimental to aquatic life. The BLM will protect the unique rocky habitats on SGL 219 through a stipulation. Well pad placement will be considered at the Notice of Staking and/or APD stage to best mitigate impacts to wildlife and other resources in SGL 219.

### ***Special-Status Species***

The Yellow-bellied fly catcher (*Empidonax flaviventris*) (state listed endangered species) has the potential to be impacted by development and production due to possible habitat reduction and avoidance of construction and development activities within the nominated lease parcel. To avoid

impacts to state-listed endangered species that use Corbin Creek Wetlands, the BLM will require applicants to submit for BLM approval a habitat protection plan if they seek permission to disturb land within the supporting landscape for the Corbin Creek Wetlands, as depicted by the Pennsylvania Natural Heritage Program's interactive map (Pennsylvania Department of Conservation and Natural Resources, 2013a).

Though there have been no recent sightings, the Proposed Action may affect Indiana bats through reduction of suitable habitat within the nominated lease parcel since almost all projects that involve removing trees have the potential to affect this species. The BLM will mitigate this risk by stipulating that applicants for permits to drill delineate all suitable Indiana bat habitat within the area proposed for development. The BLM will use that habitat delineation to determine, through formal or informal consultation with the U.S. Fish and Wildlife Service, whether the proposed wells and construction are likely to affect the Indiana bat and whether additional conservation measures must be implemented to avoid and minimize impacts to the species.

The northern long-eared bat is currently proposed to be listed and occurs in a similar habitat, and would likely have the same potential impacts as the Indiana bat mentioned above. A stipulation prohibiting summertime tree cutting will be implemented for the protection of the northern long-eared bat, and the BLM will require operators to gather additional information on the habitat for the purpose of consulting with the Fish and Wildlife Service regarding the Indiana bat.

The BLM sent a letter to the U.S. Fish and Wildlife Service on September 3, 2013, requesting its concurrence that the BLM's protective measures would result in the project being not likely to impact Indiana bat and received a response on March 19, 2014 (Appendix C) that has been incorporated into this document.

### **Geology/Mineral Resources/Energy Production**

The proposed action is expected to allow for the dry gas in the Marcellus shale to be fully developed, representing an irreversible and irretrievable commitment of these resources.

### **Hazardous Wastes**

While the act of leasing Federal minerals would produce no impacts on the environment from hazardous or solid wastes, subsequent exploration/development of the proposed lease could result in the introduction of hazardous and non-hazardous substances to the site. Hazardous substances may be produced, used, stored, transported or disposed of by development and production of minerals on the proposed lease.

Projects typically generate the following wastes; (1) discharge of drilling fluids and cuttings into the reserve pits; (2) wastes generated from used lubrication oils, hydraulic fluids, and other fluids used during production of oil and gas, some of which may be characteristic or listed hazardous waste; and (3) service company wastes from exploration and production activities as well as containment of some general trash. Certain wastes unique to the exploration, development, and production of crude oil and natural gas have been exempted from Federal Regulations as hazardous waste under the RCRA, Subtitle

C (40 C.F.R. § 260-299). The exempt waste must be intrinsic to exploration, development or production activities and cannot be generated as part of a transportation or manufacturing operation. The drilling fluids, drill cuttings, and produced waters are classified as a RCRA exempt waste, and potential drilling that could occur would not introduce hazardous substances into the environment if they are managed and disposed of properly under Federal, state, and local waste management regulations and guidelines. Properly used, stored, and disposed of hazardous and non-hazardous substances greatly decreases the potential for any impact on any environmental resources. Operators and the BLM can ensure hazardous and non-hazardous substances are properly managed through the preparation of a Spill Prevention, Control, and Countermeasure Plan (SPCCP).

In hydraulic fracturing, chemical substances other than water make up a small percentage of the fluid composition; however, the very large volumes used require correspondingly large volumes of a variety of compounds. These substances range from the relatively benign to the highly toxic at certain concentrations. In addition to these added chemicals, naturally occurring toxicants such as heavy metals, volatile organics, and radioactive compounds are mobilized during extraction and return to the surface with the produced water. Although the risk is low, the potential exists for unplanned releases that could have serious effects on human health and environment. A number of chemical additives are used that could be hazardous, but are safe when properly handled according to requirements and long-standing industry practices. In addition, many of these additives are common chemicals which people regularly encounter everyday (Ground Water Protection Council & ALL Consulting, 2009).

Surface spills of drilling mud and additives, hydraulic fracturing fluids and additives, flowback water, and other produced water can happen at a variety of points in the development and production phases. Spills that occur can span a range of different spill sizes and causes of failure at any point in the process. For example, small spills often happen as the result of poor pipe connections or leaks; large spills sometimes occur as the result of a major well blowout, but such blowouts rarely occur. Additionally, spills from some parts of the phases may be the result of human error (i.e. vehicle collisions, improper handling, improper equipment operation or installation, etc.), while others stem from equipment failure (i.e. broken pipes, torn pit liners, leaking tanks, etc.) or acts of nature (Fletcher, 2012). The most common cause of spills comes from equipment failure and corrosion (Wenzel, 2012).

The cause of the spill, the spill size, the hazard rating of the spilled material, response time to clean up the spill and the effectiveness of the cleanup, all play a critical role in determining the overall impact on the environment. The volume of a spill can significantly vary with spill types. Pipe spills are not expected to release more than 1,000 gallons into the environment, retaining pit spills and truck spills are not expected to release more than 10,000 gallons of fluid, and blowouts are expected to cause the largest spills, with the potential to release tens of thousands of gallons into the environment. Small spills occur with greater frequency than large spills. Secondary containment or recovery for small spills would likely minimize, if not eliminate, any potential release into the environment. However, for spills of several thousands of gallons of fluid, it is expected that less than half the fluid may be captured by secondary containment or recovery. The vast majority of operations do not incur reportable spills (five gallons or more), indicating that the fluid management process can be, and usually is, managed safely and effectively (Fletcher, 2012).

## Mitigation

Specific mitigation is deferred to the APD process. However, the following measures are common to most projects:

- all trash would be placed in a portable trash cage and hauled to an approved landfill, with no burial or burning of trash permitted,
- chemical toilets would be provided for human waste,
- fresh water zones encountered during drilling operations would be isolated by using casing and cementing procedures,
- a berm or dike would enclose all production facilities if a well is productive, and
- all waste from all waste streams on site would be removed to an approved disposal site.

Future development activities on these lease sale parcels would be regulated under the RCRA, Subtitle C (40 C.F.R. § 260-299). RCRA requirements are not industry-specific but apply to any company that generates, transports, treats, stores, or disposes of hazardous waste. Waste management requirements are included in the 12-point surface use plan and the 9-point drilling plan required for all APDs. Leaseholders proposing development would be required to have approved SPCCPs, if the applicable requirements of 40 C.F.R. §112 are met, and comply with all requirements for reporting of undesirable events. Lease bonds would not be released until all facilities have been removed, wells are plugged, and satisfactory reclamation has occurred.

There are BLM COAs that would be applied at the APD stage regarding handling and disposing of wastes. There would also be more site specific COA's based on consultation with the Pennsylvania State Game Commission regarding hazardous wastes.

## Cultural Resources

A letter from the PBHP to BLM dated October 22, 2013, stated that there is a high probability of cultural resources located in and around the decision area, and that all ground disturbances would require archaeological surveys, records searches, and additional consultation.

## Native American Religious Concerns

The BLM sent letters on September 6, 2013, to nine Federally Recognized Indian Tribes with a known connection to the decision area asking them to identify any concerns that would need special consideration with respect to the proposed action. The Delaware Tribe of Indians and the Delaware Nation responded that they have no knowledge of any cultural resources important to their respective Tribes within the decision area, but wish to be consulted for all future actions related to this EOI (see Persons Consulted section for more information).

The BLM's responsibility is limited to the area of surface disturbance if or when a proposal for development is submitted. If an APD is submitted after the issuance of a lease, the BLM will consider

potential Native American religious concerns connected with such an action. No further analysis is warranted at this time.

## Recreation

Construction, drilling and well completion activities coinciding with dispersed recreational activities such as hunting, hiking, horseback riding, sightseeing, wildlife viewing and other recreational activities would likely adversely affect the visual and aesthetic experience of person engaged in such activities. Wildlife may also be displaced, resulting in diminished hunting success immediately adjacent to drilling, completion and production activities

To minimize impacts to recreationists during peak hunting, the PGC has implemented periods limiting certain drilling activities (including hydraulic fracturing or well completion), hauling, tree cutting, or road and pipeline construction will not be permitted on the dates noted in Table 1 below unless otherwise approved in writing by the PGC. Once the well is placed into production and the pad placed into interim reclamation activity on the location is greatly diminished for the production life of the well, which should cut down on its impacts to recreational activities in most areas.

Table 1

Restrictive Period	
1	The opening day of archery deer season
2	The opening day of any youth or special-use hunting season
3	The opening day of early fall muzzleloader deer season
4	The opening day of early small game season
5	The opening Day of general small game season
6	The first three days of the antlered and antlerless or concurrent antler and antlerless firearms deer season
7	All Saturdays of firearms deer season
8	The opening day of fall and spring turkey season
9	The opening day of bear season
10	The opening day of elk season

## Socioeconomics

Local economic effects of leasing Federal minerals for oil and gas exploration, development, and production are influenced by the number of acres leased and estimated levels of production. Federal oil and gas leases generate a one-time lease bonus bid as well as annual rents. The minimum competitive lease bid is \$2.00 per acre. If parcels do not receive the minimum bid they may be leased later as noncompetitive leases that don't generate bonus bids. Lease rental is \$1.50 per acre per year for the first five years and \$2.00 per acre per year thereafter. Typically, oil and gas leases expire after 10 years unless held by production. During the lease period annual lease rents continue until one or more wells are drilled that result in production and associated royalties.

For the state of Pennsylvania in 2011, average wellhead prices were \$87.16 per barrel (bbl.) for crude oil and \$6.28 for natural gas. Statewide average output per producing well was 114 bbls. of crude oil and 26,586 Million cubic Feet (McF) of natural gas from 8,590 producing crude oil wells and 45,646 producing natural gas wells, respectively. In 2011, the state of Pennsylvania ranked twentieth in crude oil production and seventh in natural gas production in the United States. Bradford County is the top oil and gas-producing county in Pennsylvania, providing 22.89% of all production in the state and 0.84% of all production in the United States (Independent Petroleum Association of America, 2013).

Federal revenues from oil and gas production disbursed to the state of Pennsylvania in Fiscal Year 2012 totaled \$67,081 (U.S. Department of Interior, 2013a). From this amount, revenues are disbursed to each local county of production. In 2012, Bradford County did not receive any payments directly related to oil and gas production on Federal lands within the county as there were no producing Federally leased wells at this time (U.S. Department of Interior, 2013b). The Federal government owns 75% of the mineral rights to the proposed lease tracts, and the state of Pennsylvania owns the remaining 25%. Should the Federal government offer the lands for lease, 25% of the Federal revenues (bonus bids, rentals and royalty) from the 75% Federal ownership would be returned to the state for distribution to local governments. These revenues help fund traditional county functions such as enforcing laws, administering justice, collecting and disbursing tax funds, providing for orderly elections, maintaining roads and highways, providing fire protection, and/or keeping records. Other county functions that may be funded include administering primary and secondary education and operating clinics/hospitals, county libraries, county airports, local landfills, and county health systems.

The RFDS (Appendix D) for the proposed action indicates the potential for drilling as many as sixty wells on these parcels. The project could generate moderate revenues in the form of royalty payments, bonus bids, and rent monies to the state and county. Additional economic benefits would include wages and salaries to employees, maintenance staff, and contractors who are employed in drilling wells; enhanced revenue for area hotels, restaurants, and other businesses that serve drillers for the duration of drilling; and similar construction-related benefits later as wells are abandoned and sites restored.

SGL 219 is managed for game conservation, hunting and other recreational pursuits that could be affected by increased oil and gas related activities. Potential impacts to recreation resource values can be found in the Recreation section above. Exploration, drilling or production could create an inconvenience to people living adjacent to leases due to increased traffic and traffic delays, road maintenance, and light, noise and visual impacts.

The amount of inconvenience could depend on the activity affected, traffic patterns within the area, noise and light levels, length of time and season these activities occur, etc. It is estimated that the average oil and gas well requires 320 to 1,365 truckloads of equipment to bring a well into production (National Park Service, 2008). Typically, truck traffic consists of the following:

- Drill Pad and Road Construction Equipment – 10 to 45 truckloads
- Drilling Rig – 30 truckloads
- Drilling Fluid and Materials – 25 to 50 truckloads
- Drilling Equipment (casing, drill pipe, etc.) 25 to 50 truckloads

- Completion Rig - 15 truckloads
- Completion Fluid and Materials – 10 to 20 truckloads
- Completion Equipment – (pipe, wellhead) 5 truckloads
- Fracture Stimulation Fluids and Materials – 100 to 1000 truckloads
- Fracture Stimulation Equipment (pump trucks, tanks) – 100 to 150 truckloads.

Local and state governments regulate heavy hauling on the roads in the area, but there are potential mitigation measures that can aid in reduction of truck traffic. Re-use of flowback wastewater can and does significantly reduce the road traffic associated with hauling water, which represents much of the traffic movement. Pipelines can be used to transport water to a drill site, further reducing the amount of road traffic very substantially (Massachusetts Institute of Technology, 2011).

Competition for housing could potentially occur in the area due to increased employment from additional drilling. Stipulations regarding drilling activities will be incorporated to minimize negative economic and social impacts to local residents, hunters, and other recreationists that use these lands.

It is an assumption that the No Action Alternative (no lease option) may result in a reduction in domestic production of oil and gas. This would likely result in reduced Federal and state royalty income, and the potential for Federal minerals to be drained by wells on adjacent private or state land.

## Soils

The BLM anticipates that operators will seek to locate well pads on level or gently-sloping ground near existing roads, which would be the preferred type of landform for minimizing erosion and avoiding wetlands and waterways. In the event that access roads, well pads, or other structures are proposed on steep slopes, the BLM would incorporate the use of BMPs, such as those recommended for oil and gas activity on state forest lands (Pennsylvania Department of Conservation and Natural Resources, 2011).

## Vegetation

Leasing itself will have no impacts, but subsequent approved drilling and its associated actions will impact approximately 42 acres of native or undisturbed vegetation, which is approximately 0.8 % of the 5194 acres (~8.12 sq. mi) being considered for leasing. Since surface occupancy will be prohibited within 300 feet of wetlands, any drilling that takes place will be in the uplands. As the PGC is the surface manager, the BLM would recommend that interim reclamation occur on each pad, access road and its associated pipeline and/or utility corridors. Refer to the **Wildlife** section of chapter four of this EA for more information.

To aid in the CMP SGL 219 mission to control invasive/exotic species and undesirable competing vegetation, the BLM recommends that the PGC require a certified or registered weed free seed mix, based on the ecological site description, that would benefit the local wildlife and provide a compatible ecological niche if successful be implemented at interim and final reclamation. It is also recommended that equipment coming from outside the field would be power washed to remove any seed before being brought into the field.



### *Special-Status Species*

The soft-leaved sedge (*Carex disperma*) (state listed species of concern) has the potential to be impacted by development and production due to possible habitat reduction and avoidance of construction and development activities within the nominated lease parcel. To avoid impacts to the state-listed species of concern that use Corbin Creek Wetlands, the BLM will require applicants to submit for BLM approval a habitat protection plan if they seek permission to disturb land within the supporting landscape for the Corbin Creek Wetlands, as depicted by the Pennsylvania Natural Heritage Program's interactive map (Pennsylvania Department of Conservation and Natural Resources, 2013a).

### *Invasive Species/Noxious Weeds*

Construction of roads, well pads, pipelines, and other structures associated with oil and gas development can spread invasive species and/or noxious weeds in two general ways. First, increased vehicle traffic may carry seeds, plant parts, or other live organisms that may become established within the decision area. This could introduce new species from outside the decision area or from one part of the decision area to another. The risk of such propagation may be estimated in terms of the area disturbed, calculated in Chapter 2 at five acres per productive well; the volume of vehicle traffic; and the presence of invasive species in locations along the routes that traffic uses on the way to and within the decision area. However, many of these species are able to propagate into undisturbed areas, and large areas of otherwise intact habitat could be infested by plant parts that are introduced into the Decision area on equipment and vehicles. Therefore, it is possible that far more than the directly disturbed area of land could be infested in non-native, invasive plant species because of the disturbance.

The second way that oil and gas development may result in the propagation of invasive species is by creating open corridors and forest edges that are highly susceptible to invasive by edge-loving species. Where the forest canopy is broken, invasive species that thrive in sunny conditions may thrive.

BMPs are available that are designed to prevent the spread of invasive species in forests due to forestry practices and right-of-way clearing (Wisconsin Council on Forestry, 2012). Several of the BMPs are directly applicable to the proposed lease, since it would incorporate rights-of-way and vegetation management on dedicated forest land. The BLM would incorporate appropriate BMPs as conditions of approval into permits to drill in order to prevent the introduction of spread of invasive species into affected areas.

The state at one time established a quarantine on ash wood, affecting adjacent Lycoming and Tioga Counties, but the quarantine has been lifted. The PGC is considering implementation of a preventive ash treatment to minimize the spread of emerald ash borer.

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### **Visual Resources**

Visual resources will not be impacted by the act of leasing, but will likely be affected by oil and gas development and production activities that could occur on the lease. A majority of the visual issues related to oil and gas operations occur during the construction and drilling phase when there is increased activity on the roads and at the location to support road and pad construction, pipeline installation, drilling and completion operations, and for interim and final reclamation. Since drilling occurs around the clock until the production zone is reached, rig and location lighting are likely to be

seen from a distance depending on rig orientation and height of the rig in use. Increased traffic, especially over gravel or dirt roads, would increase particulate matter that may be visible from roads, residences, and/or by recreational users in the area. For the production life of the pad there will be a well head(s) and possible lift system(s) with production facilities and production tanks. Surface operations will be under the PGC direction of authority.

### ***Mitigation***

In areas of visual concern the BLM will recommend to the PGC:

- low profile tanks be utilized,
- utility lines be buried,
- all permanent facilities on location be painted color(s) that blend with the surrounding vegetation/landscape,
- utilization of soil stockpiles to block the view shed,
- bussing employees in to minimize vehicular traffic, and
- pad placement and orientation best minimizes visual impact.

Due to immediate safety of life it is difficult to manage all lighting especially on the derrick as shadows pose an issue; however, rig orientation should be considered to minimize impacts. The BLM will also recommend to the PGC that all other lighting on the location unnecessary for immediate safety of life be directed to the center of the pad and that lights have shrouds to better direct light away from critical areas. Upon the pad being placed into interim reclamation, the visible footprint will become less visible for the production life of the pad. The rolling terrain could also be utilized to further mitigate the visual impacts of all activities related to oil and gas development.

### **Water Resources, Surface/Ground**

While the act of leasing Federal minerals would produce no impacts to water resources, subsequent exploration and development of the proposed lease may produce impacts. Surface disturbance from the construction of well pads, access roads, pipelines, and utility corridors can result in degradation of surface water and groundwater quality from non-point source pollution, increased soil losses, and increased erosion.

#### ***Surface Water***

Potential impacts to surface water that may occur due to construction of well pads, access roads, fracturing ponds, pipelines, utility lines and production include:

- Increased surface runoff and off-site sedimentation brought about by soil disturbance
- Increased salt loading and water quality impairment of surface waters
- Channel morphology changes due to road and pipeline crossings and possible contamination of surface waters by spills

The magnitude of these impacts to water resources would depend on the proximity of the disturbance to the drainage channel, slope aspect and gradient, degree and area of soil disturbance, amount of local

precipitation, soil character, and duration and time before implementation mitigation or clean up measures can be put into place.

Direct impacts would likely be greatest shortly after the start of construction activities and would decrease in time due to decreased activity during production, natural stabilization and reclamation efforts. Construction activities would occur over a relatively short period; therefore, the majority of the disturbance would be temporary and localized. Flows of perennial, ephemeral, or intermittent rivers and streams can be directly affected in the short term by an increase in impervious surfaces resulting from the construction of the well pad and road. An increase in impervious surfaces provides for reduced infiltration that can then cause overland to move more quickly causing peak flow to potentially occur earlier, have a higher flow velocity and/or a larger volume than the channels are equipped for. Increased velocity and volume of peak flow can cause bank erosion, channel widening, downward incision, and disconnection to the floodplain. The potential hydrologic effect to low flow is reduced surface storage and groundwater recharge, which can then result in reduced base flow to perennial rivers and/or streams and potentially causing intermittent channels to become ephemeral. Hydrologic processes may be altered where the perennial, ephemeral, and intermittent river and stream system responds by changing physical parameters, such as channel configuration. These changes may impact water quality and ultimately the aquatic ecosystem through eutrophication, changes in water temperature, and/or a change in the food structure.

Minor long-term direct and indirect impacts to the watershed and hydrology could continue for the life of surface disturbance from water discharge from roads, road ditches, and well pads, but would decrease once all well pads and road surfacing material has been removed and reclamation of well pads, access roads, pipelines, and power lines have taken place. Interim reclamation of the portion of the well pad not needed for production operation, re-vegetating the portion of the pad needed for production operations, and re-vegetating road ditches would reduce this long-term impact. Short-term direct and indirect impacts to the watershed and hydrology from access roads that are not surfaced with impervious materials would occur and would likely decrease in time due to reclamation efforts.

#### *Ground Water*

Groundwater could be affected by multiple factors, including industrial, domestic, or agricultural activities through withdrawal, injection (including chemical injection), or mixing of materials from different geologic layers or the surface. Withdrawal of groundwater could affect local groundwater flow patterns and create changes in the quality or quantity of the remaining groundwater. Water withdrawals for shale gas development from tight shale formations are regulated by the SRBC, and the SRBC evaluates proposed withdrawals with respect to their expected impacts to aquatic resources. Each proposed water withdrawal for each proposed gas well will have to receive approval from the SRBC. The SRBC grants these approvals based on the demonstrated need for the well and the availability of that volume of water in the watershed during normal hydrologic conditions, and approvals may contain conditions under which withdrawals must be interrupted. The SRBC estimates that the entire gas industry consumed 10 million gallons per day (gpd) in 2011 and that this figure may reach 30 million gpd at the industry's full build-out phase. The SRBC has stated that the water-rich Susquehanna River Basin can accommodate these levels of water withdrawal during times of normal or high flows and that the

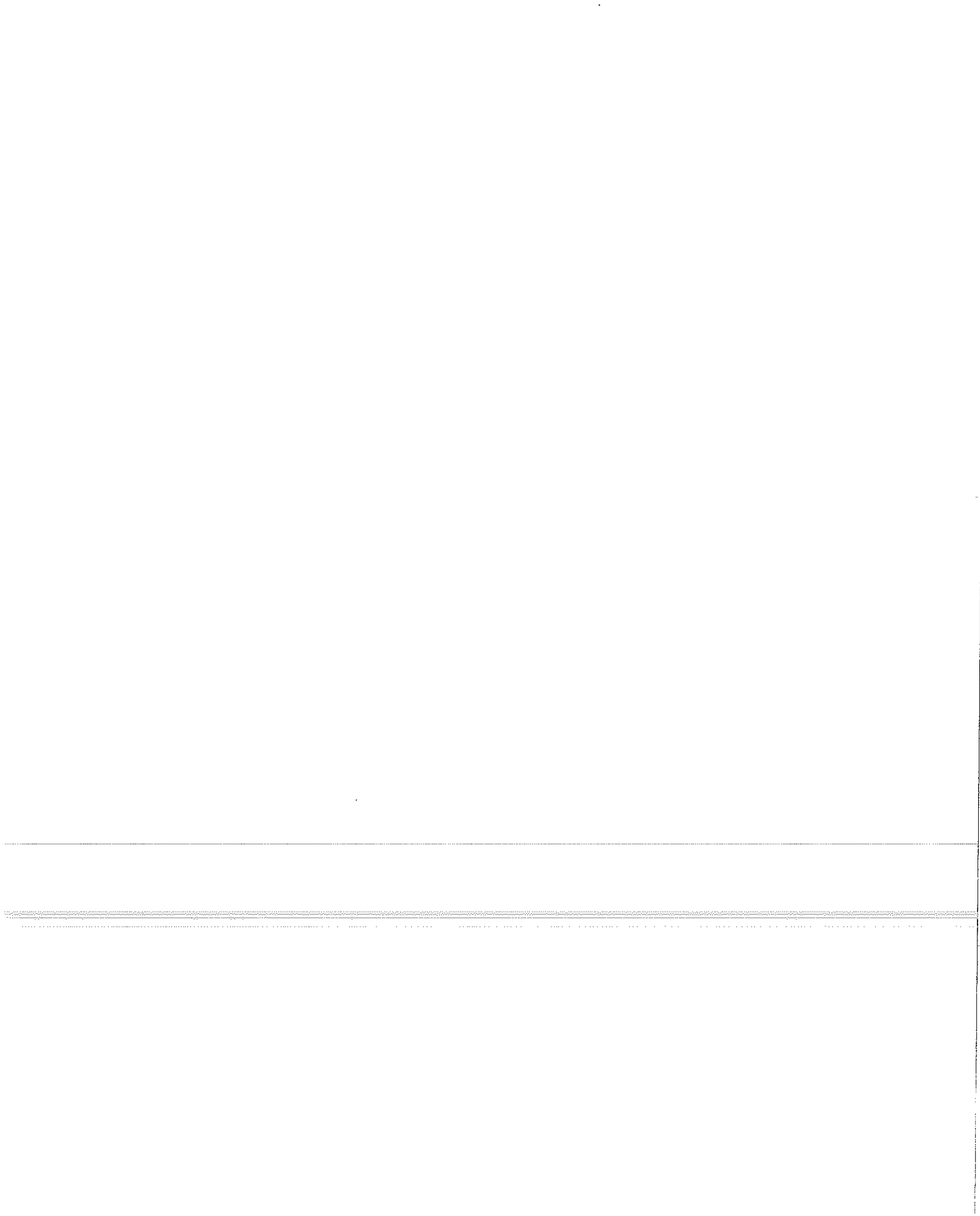
required protective measures will adequately protect water resources during times of below-normal flows (Susquehanna River Basin Commission, 2005).

Drilling horizontal wells, versus directional and vertical wells, may initially appear to require a greater volume of water for drilling/completion purposes. However, a horizontal well develops a much larger area of the reservoir than a directional and/or vertical well and actually results in a lesser volume of fluids being required. Vertical and directional wells can easily require one well per 10 acres resulting in 64 wells per section. This is in contrast to one horizontal well per 640 acres or one per 320 acres which results in a net decrease in total fluid volumes needed and in surface disturbance acreages. Impacts to the quality of groundwater, should they occur, would likely be limited to near a well bore location due to inferred groundwater flow conditions in the area of the parcels.

Oil and gas contained in geologic formations is often not under sufficient hydraulic pressure to flow freely to a production well. The formation may have low permeability or the area immediately surrounding the well may become packed with cuttings. A number of techniques are used to increase or enhance the flow. They include hydraulic fracturing and acid introduction to dissolve the formation matrix and create larger void space(s). The use of these flow enhancement techniques and secondary recovery methods result in physical changes to the geologic formation that will affect the hydraulic properties of the formation. Typically, the effects of these techniques and methods are localized to the area immediately surrounding the individual well, are limited to the specific oil and gas reservoir, and do not impact adjacent aquifers.

There is an elevated public concern about the possibility of subsurface hydraulic fracturing operations creating fractures that extend well beyond the target formation to water aquifers, allowing CH<sub>4</sub>, contaminants naturally occurring in formation water, and fracturing fluids to migrate from the target formation into drinking water supplies (Zoback, Kitasei, & Copithorne, 2010). Typically, thousands of feet of rock, including some impermeable, separate most major formations in the U.S. from the base of aquifers that contain drinkable water (U.S. Department of Energy, 2009). The direct contamination of underground sources of drinking water from fractures created by hydraulic fracturing would require hydrofractures to propagate several thousand feet beyond the upward boundary of the target formations through many layers of rock. It is extremely unlikely that the fractures would ever reach fresh water zones and contaminate freshwater aquifers (Zoback, et al, 2010). In the current case, the lowest potable groundwater and the top of the production zone are separated by approximately 10,000 feet. During the APD review, the exact difference between the base of treatable water and the top of the target formation for the specific site would be reviewed to determine the potential for direct contamination of underground sources. Averaging the total depth of existing wells in Bradford County suggest the average depth of the wells would be approximately 10,900 feet and have multiple 5,000 foot average horizontal legs.

Contamination of groundwater could occur without adequate cementing and casing of the proposed well bore. For fracturing fluid to escape the wellbore and affect the usable quality water or contaminate or cross contaminate aquifers, the fluid would have to breach several layers of steel casing and cement. Failure of the cement or casing surrounding the wellbore is a possible risk to water supplies. If the



annulus is improperly sealed, natural gas, fracturing fluids, and formation water containing high concentrations of dissolved solids may be transferred directly along the outside of the wellbore among the target formation, drinking water aquifers, and layers of rock in between.

Casing specifications are designed and submitted to the BLM. The BLM independently verifies the casing program, and the installation of the casing and cementing operations are witnessed onsite by a BLM Petroleum Engineer. Petroleum products and other chemicals used in the drilling and/or completion process could result in groundwater contamination through a variety of operational sources including, but not limited to, pipeline and well casing failure, well (gas and water) construction, and spills. Similarly, improper construction and management of reserve and evaporation pits could degrade ground water quality through leakage and leaching.

The potential for negative impacts to groundwater caused from completion activities such as hydraulic fracturing have not been confirmed, but based on its history of use are not likely. A recent study completed on the Pinedale Anticline in Wyoming did not find a direct link to known detections of petroleum hydrocarbons to the hydraulic fracturing process (AMEC Environment & Infrastructure, Inc., 2013). Authorization of any proposed drilling project would require full compliance with local, state, and Federal directives and stipulations that relate to surface and groundwater protection and the BLM would deny any APD where the proposed drilling and/or completion process was deemed not protective of usable water zones as required by 43 C.F.R. § 3162.5-2(d).

A high risk of fluid migration exists along the vertical pathways created by inadequately constructed wells and unplugged inactive wells. Brine or hydrocarbons can migrate to overlying or underlying aquifers in such wells. This problem is well known in the oil fields around Midland, TX. Since the 1930s, most states have required that multiple barriers be included in well construction and abandonment to prevent migration of injected water, formation fluids, and produced fluids. These barriers include (1) setting surface casing below all known aquifers and cementing the casing to the surface, and (2) extending the casing from the surface to the production or injection interval and cementing the interval. Barriers that prevent fluid migration in abandoned wells include cement or mechanical plugs. They should be installed (1) at points where the casing has been cut, (2) at the base of the lowermost aquifer, (3) across the surface casing shoe, and (4) at the surface. Individual states and the BLM have casing programs for oil and gas wells to limit cross contamination of aquifers.

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Impacts of water use for oil and gas development and production depend on local water availability and competition for water from other users. Overall, impacts range from declining water levels at the regional or local scales and related decreases in base flow to streams (Nicot & Scanlon, 2012). Water supplied for hydraulic fracturing could come from surface or groundwater sources. If surface water is used, there could be a temporary decrease in the source's water levels depending upon the conditions at the time of withdrawal. The time it takes to return to baseline conditions is dependent on the amount of rainfall received and other competing uses of the resource.

Typically when groundwater is used as a source of drilling/completion water, impacts to the aquifer would be minimal due to the size of the aquifers impacted and recharge potential across the entire

aquifer. However, localized aquifer effects could be expected depending upon the rate of drawdown and the density and/or intensity of the drilling activity. A cone of depression may occur in the immediate vicinity of the existing water well used to supply the drilling/completion water. With each rain event, the aquifer is expected to recharge to some degree, but it is unknown if or when it would recharge to baseline conditions after pumping ceases which is dependent upon surface conditions (whether impervious surface or not). The time it takes depends greatly on rainfall events, surface soil materials, drought conditions, and frequency of pumping that has already occurred and will continue to occur into the future.

The amount of water actually used for drilling/completion activities is highly dependent on a number of factors including: length of well bore, closed-loop or reserve pit drilling system, type of mud, whether hydraulic fracturing would be used during stimulation, whether recycled water would be used, dust abatement needs, and type and extent of construction, to name a few. The impacts of water use on water quality and quantity along with specific draw down requirements and permits would be analyzed in more detail during the APD review.

Any proposed drilling/completion activities would have to comply with Onshore Order #2, 43 C.F.R. 3160 regulations, and not result in a violation of a Federal and/or state law. If these conditions are not met, the proposal would be denied. As such, no significant impacts to groundwater from the proposed action are expected.

### ***Mitigation***

The BLM recommends BMPs requiring fluid impermeable containment systems (i.e. liners, dikes, berms) be placed in, under and/or around any tank, pit, drilling cellar, ditches associated with the drilling process, or other equipment that use or has the potential to leak/spill hazardous and non-hazardous fluids, to prevent chemicals from penetrating the soil and impacting the aquifer or from moving off-site to a surface water source.

The BLM will closely analyze areas proposed for drilling in APDs during the onsite inspection, since regional wetland inventories often do not capture small wetlands. EPA requires that Storm Water Pollution Prevention Plans and SPCCPs be in place to prevent any spill from reaching surface water due to rain events or accidental release of fluids related to production operations.

A lease stipulation (Appendix B) will establish protective buffers of 300 feet around wetlands and waterways. This will prevent direct filling of wetlands and mitigate the risk of spills contaminating surface waters. Because wells could potentially be directionally drilled from outside the EO1, prohibiting surface occupancy in wetlands would not necessarily prevent accessing the minerals under the wetlands. The BLM will closely analyze areas proposed for drilling in APDs, since regional wetland inventories often do not capture small wetlands. EPA requires that Storm Water Pollution Prevention Plans and Spill Prevention Control and Countermeasure Plans be in place to prevent any spill from reaching surface water due to rain events or accidental release of fluids related to production operations.

Complying with BLM and state regulations regarding casing and cementing, implementing BMPs, testing casings and cement prior to continuing to drill or introducing additional fluids and continual monitoring during drilling and hydraulic fracturing, allow producers and regulators to check the integrity of casing and cement jobs and greatly reduce the chance of aquifer contamination.

Potential mitigation for flood plains and wetlands is deferred to site-specific development at the APD stage.

## CHAPTER 5 – PERSONS, GROUPS, AND AGENCIES CONSULTED

### Consultation and Coordination

#### List of Persons, Agencies and Organizations Consulted

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Kerry Speelman, Oil/Gas and Mineral Development Section, Pennsylvania Game Commission	Natural resources data from State Game Lands 219	Established areas and resources to be protected through stipulations
Michael DiMatteo, PG, Chief, Environmental Planning & Habitat Protection Division, Bureau of Wildlife Habitat Management, Pennsylvania Game Commission	Acquire land use plan for State Game Lands 219	Received Comprehensive Management Plan for Pennsylvania State Game Lands 219 on 6/20/2014
Pennsylvania Bureau of Historic Preservation State Historic Preservation Office Harrisburg, Pennsylvania	Antiquities Act, Section 106	Consultation initiated by letter; reply received by letter dated October 22, 2013. Stated that all ground disturbing activities would require further consultation and archaeological surveys.
Lora Zimmerman, USFWS, Pennsylvania Field Office, South College, Pennsylvania	Endangered Species Act, Section 7	Consultation Letter sent to USFWS on September 3, 2013; reply received from USFWS by letter dated March 19, 2014 included as Appendix C. Stated that BLM should consider the possibility of the northern



Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
		long-eared bat to be listed. Also recommended that restriction for tree cutting include trees down to 3 inches in diameter at breast height for nesting habitat.
Chief William Jacobs Cayuga Nation of New York Seneca Falls, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; no response, assumes no concerns or issues at this time.
President Kerry Holton The Delaware Nation Anadarko, Oklahoma	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; email response from the Tribe on September 25, 2013, asked for more information. Response email by archeologist Jarrod Kellogg informed Raekel Maldonado, assistant to Tamara Fourkiller (Tribal Historic Preservation Officer), that the EOI would not include any ground disturbing activity and only if the parcel is sold at a lease sale and development is proposed, would there be any archeological surveys. Additional consultation would also be conducted at that time.
Chief Paula Pechonick The Delaware Tribe of Indians Bartlesville, Oklahoma	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; reply received by letter dated October 4, 2013 stating no religious or culturally significant sites in the proposed area. Tribe wishes to continue to be consulted.

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Nation Representative Raymond Halbritter Verona, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; no response, assumes no concerns or issues at this time.
Faithkeeper Tony Gonyea Onondaga Nation Nedrow, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; no response, assumes no concerns or issues at this time.
Chief Randy Hart St. Regis Mohawk Tribe Akwasasne, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; no response, assumes no concerns or issues at this time.
President Barry E. Snyder Seneca Nation of New York Irving, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; no response, assumes no concerns or issues at this time.
Chief Leo Henry Tuscarora Nation Lewiston, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; no response, assumes no concerns or issues at this time.
Chief Roger Hill Tonawanda Seneca Nation Basom, New York	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Consultation letter sent to Tribe on September 4, 2013; no response, assumes no concerns or issues at this time.

## List of Preparers

### BLM Preparers

Name	Title	Responsible for the Following Section(s) of this Document
Derek Strohl/Kyle Schumacher	Natural Resources Specialists	Air Quality, Climate Change, Prime and Unique Farmlands, Fish and Wildlife, Floodplains, Hazardous Wastes, Invasive Species/Noxious Weeds, Soils, Threatened, Endangered, or Candidate Animal Species/Migratory Birds, Vegetation, Visual Resources, Water Resources/Quality (Drinking/Surface/Ground), Wetland/Riparian Zones, Wild and Scenic Rivers, and Wilderness
Jarrold X Kellogg	Archeologist	Cultural Resources, Paleontological Resources, Native American Religious Concerns, Recreation
Kurt Wadzinski	Planning and Environmental Coordinator	Environmental Justice, Socioeconomics
Jeff Nolder	Geologist	Geology/Mineral Resources/Energy Production

## CHAPTER 6 - REFERENCES

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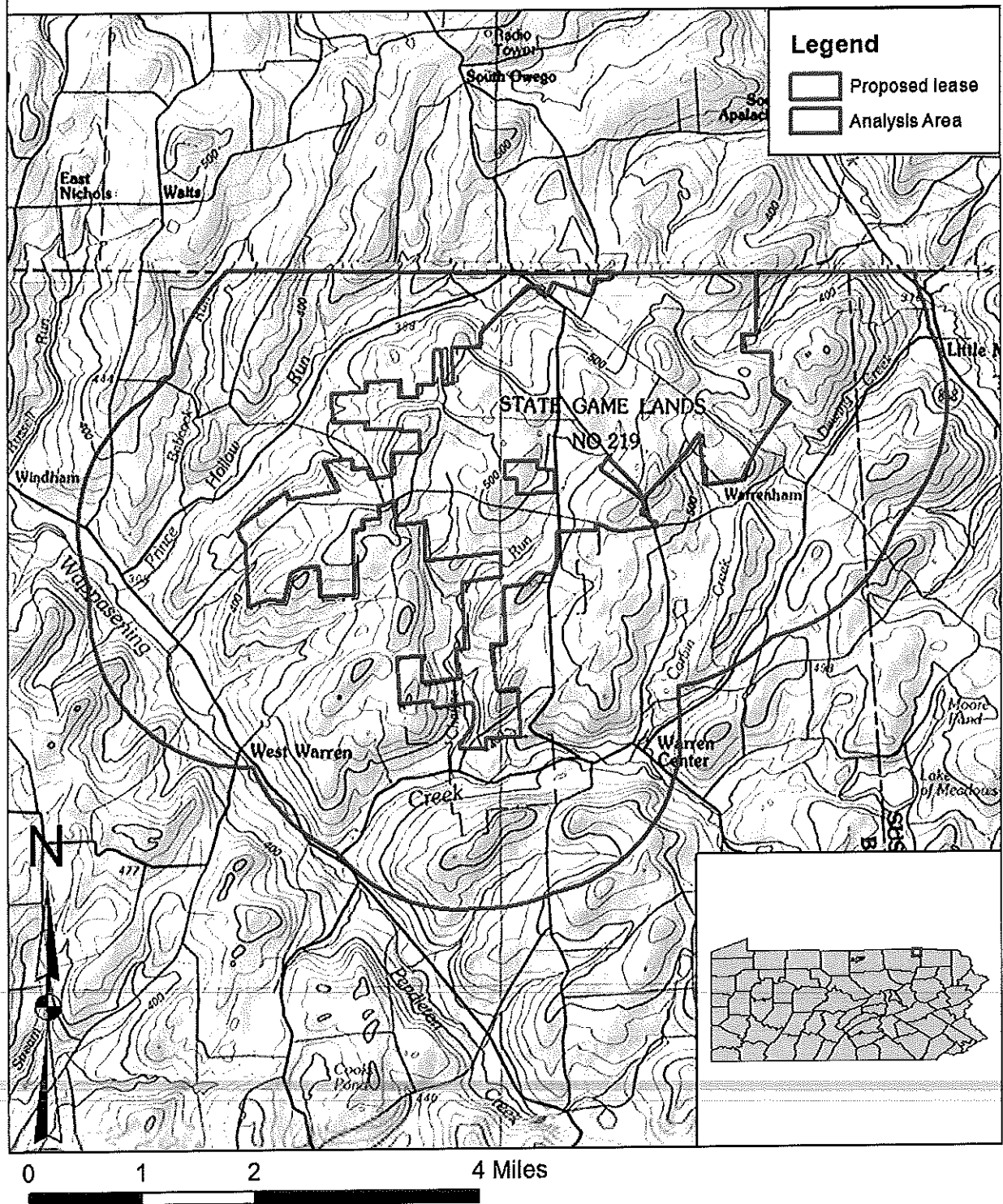
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## **CHAPTER 7 - APPENDICES**

### **APPENDIX A – FIGURES**

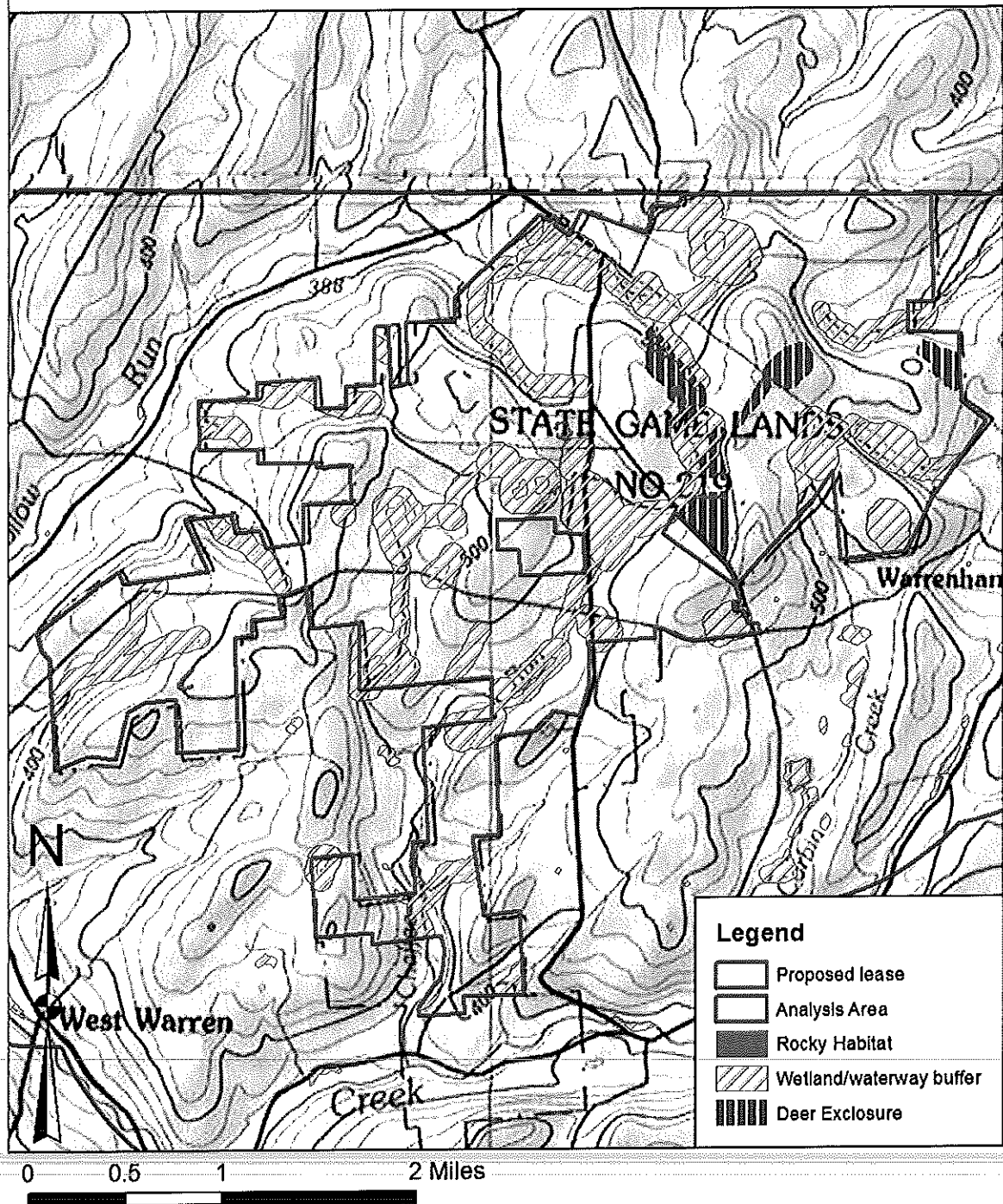
Figure 1. Proposed lease and Decision Area.



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.



Figure 2. Stipulated avoidance areas.



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.



## APPENDIX B – STIPULATIONS AND NOTICES

### LEASE NOTICES

1. The area that may be developed contains many wetlands, including many small seeps and other wetlands that do not have saturated soils year-round. Disturbance in or discharge into wetlands must comply with the Clean Water Act, notably Sections 401 (Water Quality Certification) and 404 (wetland filling). Applicants for drilling permits will be required to conduct a wetland survey of areas to be disturbed.
2. Applicants for drilling permits will be required to conduct a cultural resources Phase I survey. Cultural resources surveys may also be required prior to the start of subsequent well operations if additional ground disturbance is planned or expected. Mitigation measures or movement of planned ground disturbance may be necessary to avoid adverse effects to cultural resources. The need and requirements for mitigation or alterations will be based on consultation between the lessee, Bureau of Land Management, the Pennsylvania Bureau for Historic Preservation, and the Advisory Council on Historic Preservation.
3. Applicants for drilling permits may be required to submit a Discovery Plan for accidental archaeological discoveries that occur during ground-disturbing activities. This may include consultation between the Bureau of Land Management, Pennsylvania Bureau for Historic Preservation, and the Advisory Council on Historic Properties.
4. The lands overlying the lease and the surrounding lands that may be used to access the lease contain suitable habitat for various species listed by the U.S. Fish and Wildlife Service or the Commonwealth of Pennsylvania as endangered, threatened, or special-concern, including the Indiana bat (*Myotis sodalis*). The BLM will comply with the Endangered Species Act when reviewing and approving Applications for Permit to Drill, and this compliance may entail applying best management practices and modifications to project location and/or timing as conditions of approval in order to avoid and minimize impacts to endangered species.

**No Surface Occupancy Stipulation**

Surface occupancy on the entire lease is subject to the following:

No surface occupancy will be permitted within 300 feet of a wetland or waterway. This stipulation affects approximately 1,500 acres.

Purpose: Protect surface water quality.

Exception: The BLM may grant exceptions, pending use of appropriate best management practices for protecting water quality, for use of existing roadways and utility rights-of-way. Exceptions must be made in writing by the BLM and the Pennsylvania Game Commission.

Waiver/modification: No waivers or modifications will be made to this stipulation.

**No Surface Occupancy Stipulation**

No surface occupancy will be permitted in the deer exclosures. This stipulation affects 165 acres.

Purpose: Protect regenerating forest.

Exception/Waiver/modification: No exceptions, waivers, or modifications will be made to this stipulation.

**No Surface Occupancy Stipulation**

Surface occupancy on the entire lease is subject to the following:

No surface occupancy will be permitted on areas of rocky habitat identified in advance by the PGC or in the process of reviewing an APD. This stipulation affects approximately 15 acres of the proposed lease.

Purpose: Protect unique wildlife habitat.

Exception/Waiver/modification: No exceptions, waivers, or modifications will be made to this stipulation.

### **Controlled Surface Use Stipulation**

Surface occupancy on the entire lease is subject to the following:

Operator shall delineate, within area to be disturbed, infestations of non-native, invasive plant species, including, but not limited to, Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), and Oriental bittersweet (*Celastrus orbiculatus*). Operator shall prepare an invasive species control plan, subject to approval by the BLM and the Pennsylvania Game Commission. The action items in the control plan will be conditions of approval of the Application for Permit to Drill. Guides to the use of recommended best management practices for controlling the spread of invasive plant species are found in *Guidelines for Administering Oil and Gas Activity on State Forest Lands*, available from the Bureau of Forestry, Department of Conservation and Natural Resources. Many of the same practices that are employed for preventing soil erosion also function to prevent the spread of invasive species.

Purpose: Protecting native vegetation communities and timber resources.

Exception/modification/waiver: No exceptions, modifications, or waivers will be made to this stipulation.



### **Controlled Surface Use Stipulation**

Surface occupancy on any lands accessing the leased minerals is subject to the following:

No trees with a diameter at breast-height (DBH) of more than five inches (three inches if the northern long-eared bat is listed) may be cut during the period starting April 1 and ending September 30.

Purpose: Avoid and minimize impacts to Indiana bat and if listed the northern long-eared bat.

Waiver: No exceptions or waivers will be made to this stipulation.

Modification: The BLM may modify this stipulation to permit tree removal if the U.S. Fish and Wildlife Service concurs that such removal is not likely to adversely impact endangered species, due either to (a) the absence of those species or (b) the innocuous nature of the tree removal with respect to the endangered species.

### **Controlled Surface Use Stipulation**

Surface occupancy on the entire lease is subject to the following:

Operator shall not dispose of any drill cuttings on the lease.

Purpose: Minimizing land disturbance in the State Game Area.

Exception/waiver/modification: No exceptions, waivers, or modifications will be made to this stipulation.

### **Controlled Surface Use Stipulation**

Surface occupancy on the entire lease is subject to the following:

No freshwater impoundment shall be permitted to be constructed or used on the lease.

Purpose: Minimizing land disturbance in the State Game Area.

Exception: The BLM may make an exception and permit the construction and use of a freshwater impoundment if the BLM and PGC agree that the impoundment on PGC land is necessary. The operator must submit a written justification of the need for the impoundment. If approved, the impoundment must be surrounded by a minimum seven-foot-tall fencing to exclude all third-party uses and wildlife, and the bottom of the fence shall be buried to a depth of at least one foot. The design of the impoundment shall be approved by the PGC and should include a means of escape for persons or animals, such as an area of more gradual slope or jute netting or mats for improved traction.

### **Controlled Surface Use Stipulation**

Surface use on PGS lands will be subject to the following:

Certain drilling activities (including hydraulic fracturing and well completion), hauling, tree cutting, or road and pipeline construction activities authorized by agreement or lease will not be permitted on the following dates

1	The opening day of archery deer season
2	The opening day of any youth or special-use hunting season
3	The opening day of early fall muzzleloader deer season
4	The opening day of early small game season
5	The opening day of general small game season
6	The first three days of the antlered and antlerless or concurrent antler and antlerless firearms deer season
7	All Saturdays of firearms deer season
8	The opening day of fall and spring turkey season

9	The opening day of bear season
10	The opening day of elk season

Purpose: Minimize impacts to recreational hunting users during peaks of various game seasons

Exception: The operator must submit in writing to the PGC who may grant an exception to these restrictions in writing.

## APPENDIX C – ENDANGERED SPECIES ACT CONSULTATION

25 MAR 14



# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Pennsylvania Field Office  
315 South Allen Street, Suite 322  
State College, Pennsylvania 16801-4850



RECEIVED

MAR 24 2014

March 19, 2014

BUREAU OF LAND MANAGEMENT  
ES-NSFO

Dean Gettinger  
Bureau of Land Management  
Northeastern States Field Office  
626 E. Wisconsin Avenue, Suite 200  
Milwaukee, WI 53202-4617

RE: USFWS Project #2014-0197

Dear Mr. Gettinger:

This responds to your letter of December 9, 2013, requesting information about federally listed and proposed endangered and threatened species within the area affected by the proposed lease of federal minerals located in Tioga State Forest and State Game Lands (SGL) 219, Bradford and Tioga Counties, Pennsylvania. This proposed project is located within the range of the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered and the northern long-eared bat (*Myotis septentrionalis*), a species that is federally proposed as endangered. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

The reasonable foreseeable development scenario (RFDS), which includes oil and gas activities associated with the mineral rights that the Bureau of Land Management (BLM) is proposing to lease, will potentially affect 300-acres of forest in Tioga State Forest and 42-acres of forest on SGL 219.

Based on a review of the project information, including the implementation of the RFDS, the Service has determined that the proposed leasing of the Federal mineral rights is not likely to adversely affect the Indiana bat.

However, the implementation of RFDS may impact the northern long-eared bat, which is currently proposed for listing as an endangered species. Species proposed for listing are not afforded protection under the ESA; however, as soon as a listing becomes effective, the

prohibition against jeopardizing its continued existence and "take"<sup>1</sup> applies regardless of an action's stage of completion. Therefore, we recommend that the effect of the project on northern long eared bats, and their habitat, be considered during the project planning and design. Information to assist you in designing a proactive avoidance and minimization measures for this species, including ecology, habitat descriptions, listing status updates, and possible conservation measures may be found at [www.fws.gov/midwest/endangered/mammals/nlba/index.html](http://www.fws.gov/midwest/endangered/mammals/nlba/index.html) (click on Northern Long-eared Bat Interim Conference and Planning Guidance).

Additionally, in the Biological Assessment, you indicate that a stipulation of the lease will be that no trees more than 5 inches diameter at breast height (DBH) may be cut during the period starting April 1 and ending September 30. However, the northern long-eared bat is known to roost in trees 3 inches DBH and greater. If the species is listed, the lease should reflect this DBH and any additional or updated avoidance and minimization measures provided for this species at the time of listing.

Your letter also indicates that lessees would be required to submit Applications for Permit to Drill prior to conducting any ground-disturbing activities in the leased area. At that time the BLM would conduct another review with the Service. Further coordination with our office is recommended as information regarding the Northern long-eared bat is being reviewed and updated.

*To avoid potential delays in reviewing your project, please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.*

If you have any questions regarding this matter, please contact Kim Faulds of my staff at 814-234-4090.

Sincerely,



Lora L. Zimmerman  
Field Office Supervisor

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<sup>1</sup> As defined in the Act, take means "... to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." "Harm" in the definition of take means an act which kills or injures wildlife. Such act may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering (50 CFR part 17.3). "Harass" means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.

## APPENDIX D – REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

### I. Summary

The Reasonably Foreseeable Development Scenario (RFDS) for the 20,342 acre analysis area indicates that, if leases issue, approximately sixty horizontal wells could be drilled from 12 pads located on or adjacent to the Federal leasehold. Five pads already constructed on private land could host wells capable of producing from the Federal leasehold. Three to four pads could be located on the leased areas, while three to four more could be located on adjacent leased private land. The surface disturbance occurring on some combination of private and state lands as a result of well pad and road construction could total as much as 42 acres (6 acres per pad, 1.2 acres per well). The well success rate in this area is 100%, with production consisting of dry natural gas.

Most of the wells drilled from Federal leasing would produce from Federal, state and private portions of the Marcellus Shale reservoir. The size of the drained area would depend on the length of the lateral portion of the hole and the depth of fractures induced in the formation. Long-term disturbance of 6 acres - the average size of a pad and access road - would occur if production is established. The initial production period of these wells is likely to exceed 15 years, and could be increased if wells are reworked or recompleted. This would not be done unless the anticipated increased production is significant. New wells may be drilled from existing pads as the Marcellus play matures, thus the pads may be occupied for much longer periods of time than the initial wells.

The Federal government owns 75% of the mineral rights to these lands, and the State of Pennsylvania owns the remaining 25%. The state also owns 100% to about 425 acres in SGL 219. Should the Federal government offer the lands for lease, 25% of the Federal revenues (bonus bids, rentals and royalty) from the 75% Federal ownership would be returned to the state for distribution to local governments.

The use of hydraulic fracture ("fracking") technology in the completion of Marcellus Shale wells has led to controversy and increasing scrutiny by industry, Federal and state authorities, academia and the public. The process has been used in oil and gas well completions for at least sixty years without apparent damage to surface resources and uses, but never at a scale that made commercial shale production viable. Issues related to the process include the large quantities of water required and the types of chemicals used in well completions, potential contamination of surface and groundwater resources, and the composition of, and methods used for handling and disposal of produced fluids and completion fluids returned to the surface.

Other issues associated with oil and gas development include increased vehicle traffic, the size and weight of many of the vehicles and attendant damage to roads and related structures, air quality in the vicinity of production facilities, and the placement of pipelines, compressors and other production infrastructure. Some wildlife biologists are also considering the effects of habitat fragmentation, especially in areas where habitats support species of concern.

## II. Introduction

A "Reasonably Foreseeable Development Scenario" (RFDS) for State Game Lands 219 (SGL 219) is a projection of oil and gas exploration, development, production, and reclamation activity. The RFDS projects oil and gas activity in a defined area for a specified period, based on the best available information and data available. This RFDS was prepared in response to Expression of Interest (EOI) 351, submitted by private entities in an area that had not produced significant quantities of oil or gas before Marcellus development began in 2009. The RFDS provides a baseline for conducting the required National Environmental Policy Act (NEPA) analysis before leasing can take place. The analysis will address potential conflicts with other surface uses and resources.

The Federal government owns 75% of the mineral estate over most of the property. The State of Pennsylvania owns the remaining 25% of the minerals and the surface, which is managed by the Pennsylvania Game Commission (PGC). The state also owns several tracts outright, with private parties owning a small parcel within the boundary. Any proposed oil and gas operations that include the leased Federal mineral ownership (FMO) would require compliance with Federal and state laws, regulations, and policies. In its role as surface management agency, the PGC has proposed an occupancy plan for SGL 219 that allows development of natural gas resources without interference with surface uses or damage to surface resources. The plan provides for access to 80-90% of the FMO. BLM intends to use this proposed plan as a basis for analysis, but the analysis may lead to changes in the final plan. The state and BLM will continue to cooperate in the NEPA analysis and the final plan.

Information regarding the wells and the drilling results used in this RFDS can be retrieved from the website created and maintained by the Pennsylvania Department of Environmental Protection, Office of Oil and Gas Management (OGM) (Pennsylvania Department of Environmental Protection, 2013)

Proposed Action: The Bureau of Land Management (BLM), the agency responsible for Federal mineral leasing, is proposing to offer Federal oil and gas leases to comply with policy regarding requests from private individuals or companies to explore for and establish production from unleased minerals. Because the Marcellus Shale production is not subject to Pennsylvania's Oil and Gas Conservation Law (Act 1961-359, 58 P.S. §§ 401-419) at this time, leasing is also needed to prevent significant drainage of Federal and state resources by production from adjacent private wells.

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The lease sale would be conducted by competitive bidding with the highest bid per acre offered by prospective lessees determining the owner of the lease. The term of a Federal lease is ten years; if after that time the lessee has not established production on the lease, the lease expires. If a lease operator establishes production, the lease remains in effect until the lease no longer produces in paying quantities. The lease operator must make annual rental payments of \$1.50 per acre for the first five years of the lease term and \$2.00 per acre thereafter.

Federal royalty on the value of the production is set at 12.5%. In addition to the state's 25% mineral interest revenues, the Federal government would return 25% of all Federal revenues (bonus bids, rental and royalties) to the state for distribution to local governments.



Applications for Permit to Drill (APD) must be submitted to the BLM for site-specific analysis under NEPA before approval of proposed operations can take place. The APD is separate from the state's drilling permit requirements. Any well proposed that includes Federally leased FMO would be analyzed under NEPA, regardless of surface location. Before any surface disturbance under a lease may begin, the lessee or lease operator must furnish proof of a performance bond. The bond ensures compliance with all lease terms, including proper drilling and production operations, plugging, abandonment, and reclamation. If a well is proposed to be drilled directionally into Federal portions of SGL 219 from a location off the leased area, evidence of landowner permission for surface use would also be required.

### **III. Description of Geology**

Location and General Geology: Federal minerals underlying SGL 219 are located entirely within Warren Township, in the northeastern corner of Bradford County, along the state border with New York. The project area is about 15 miles east of Sayre, Pennsylvania and 15 miles southwest of Binghamton, New York. Access to the property is provided by a network of local and state roads west of State Highway 858 and southeast of State Route 1040.

The property is located in the United States Geological Survey's Kanawha section of the Appalachian Plateaus physiographic province. The Pennsylvania Geological Survey has further subdivided that section, and the property is a part of the Glaciated Low Plateaus. The terrain consists of rounded hills separated by broad, widely spaced stream valleys. Elevations range from just over 1200 to more than 1700 feet. The area is part of the North Branch (or Upper) Susquehanna River watershed, and is drained by tributaries of Wappasening Creek to the southwest and Apalachin Creek to the east.

The region is situated within the east-central portion of the central Appalachian Basin, an arcuate sedimentary basin elongated from western New England southwest to Ohio, West Virginia and northeastern Kentucky. The sediments reach depths over 15,000 feet in Berks County, southeastern Pennsylvania. Beneath the sedimentary section are crystalline basement rocks of the metamorphic Grenville Province. The sediments range in age from Cambrian, exposed in the southern part of the state, to Permian in the southwest.

Under a veneer of glacial till that is thickest in the stream valleys, the bedrock underlying much of SGL 219 consists of the Devonian Lock Haven Formation, made up of fossiliferous marine sandstone, siltstone, claystone and thin conglomerates. Sandstone, siltstone and shale of the upper Devonian Catskill Formation overlie the Lock Haven, capping some hills in the area.

Structure in the area consists of bedrock dipping southerly toward the basin axis. Superimposed on this is an east-trending syncline with an axis that passes just south of the property. The deep structure is not yet well understood, but some models indicate deep transverse faulting in the region (Wickstrom, et al., 2006). One fault in this network appears just west of the property. The recent focus on natural gas exploration in the region has added a great deal of drillhole and seismic data allowing more detailed analysis of the deep geologic structure.

**Economic Geology:** Before 2005, the only significant mineral development in Bradford County consisted of limited coal production, scattered sand and gravel operations and limestone and dimension sandstone ("bluestone") quarries. Coalbed methane and an Oriskany natural gas pool, the Stagecoach Field, had been the only hydrocarbons produced in the county, and exploration activity was low. The Marcellus Shale had long been known to contain natural gas, but the volumes from vertical shale wells were not sufficient to justify infrastructure investment.

In 2005, Range Resources drilled and completed the first horizontal Marcellus well in Washington County, in southwestern Pennsylvania. The well was kicked off a vertical Marcellus well, the Renz #1, which had been completed at about 300 thousand cubic feet of gas per day (Mcf/d). The first horizontal leg (lateral) of the well, modeled after completions in the Barnett Shale in the Fort Worth basin, Texas, tested at 4000 Mcf/d. The announcement of the results created a leasing boom in the state which continues to the present.

Subsequent Marcellus drilling along the northern tier of eastern Pennsylvania counties also continues today, although the rate of new well starts has slowed. Many of the wells already drilled await pipeline connections, and the current wellhead price of "dry" gas, or nearly pure methane with no natural gas liquids (NGL) is low. Projections indicate that the price of gas will remain below \$5.00/Mcf until the economy adjusts its energy source profile to expand the use of natural gas in power generation and vehicle fuels. Efforts are also underway to increase exports of liquid natural gas (LNG).

Some companies in the Marcellus play are evaluating the conversion of not only their vehicles but their heavy equipment to use natural gas as fuel, and at least one company is exploring the use of natural gas instead of water in fracking operations.

#### **IV. Past and Present Oil and Gas Exploration Activity**

**Geophysical Exploration:** From the late 1940s through the early 1950s, geophysical exploration was conducted in portions of the area to detect folding associated with traps in the Oriskany sandstone. Improvements over the years led to the discovery of smaller Oriskany fields, including the Stagecoach Field about ten miles west of SGL 219. Other geophysical exploration activity targeted the deep Trenton-Black River play.

The onset of Marcellus Shale development has increased geophysical activity markedly in the region, along with volume and quality of data. Regional "shoots", often done on a speculative basis for sale to prospective lessees, have been replaced in large part by concentrated 3-D seismic programs designed to detail areas around prospective drillsites, both to confirm target zones and to identify possible impediments to drilling and completion, such as faults. Both road-based "thumper" truck surveys and overland grids using explosives have been used. Results may be transmitted by satellite for immediate analysis by decision-makers.

**Exploratory drilling:** Before the first Marcellus Shale well was drilled in 2008, Warren Township had little history of exploratory drilling. The nearest recorded oil and gas exploration occurred to the west, in

Litchfield Township near Sayre, and resulted in the extension of an Oriskany sandstone reservoir, the Stagecoach Field (now converted largely to gas storage). A few coalbed methane wells were drilled in the southwestern part of the county.

The initial Marcellus development involved a few vertical wells that were cored to determine basic formation data such as porosity, total organic content (TOC), fracture density, and other reservoir parameters important to production. Vertical wells were later converted to production, plugged and abandoned, or used as pilot holes for horizontal wells. With the exception of the northern border of the property, SGL 219 is surrounded by wells either producing or capable of production.

Other Devonian shale zones may be capable of commercial production. In other parts of the Marcellus play, the overlying Rhinestreet, Canisteo, and Burket shale members have been tested and found to be commercially viable. Although the deeper Utica shale is present at thicknesses over 500 feet, in this area it is overmature and contains no producible hydrocarbons.

## **V. Past and Present Oil and Gas Development Activity**

There had been no recorded oil and gas development activity in Warren Township, and very little in Bradford County, prior to 1992. Unrecorded (pre-regulatory) oil and gas activity in the area is uncertain, but the presence of unknown abandoned and/or orphan wells in the area is unlikely to be a significant issue in an area where so little recorded activity had occurred before the Marcellus play opened.

Permits for 71 Marcellus wells have been approved by the State of Pennsylvania for the township. Of the 26 wells drilled as a result, eight have recently begun production. The remaining wells are shut in pending pipeline connections. Portions of the laterals of 11 of these wells are within one mile of SGL 219, with one (Strope #5) in production. The laterals average about 5000 feet in length, and are separated from each other, or spaced, by about 1000 feet. Wells are oriented in a northwest-southeast direction to maximize fracture density in each well. Wells usually take 20-30 days to drill on a 24-7 basis, with another week to ten days for completion. After completion, wells are usually allowed to stabilize, or “rest”, for periods of three to six months. Wells are then tested, which can take up to a week. In some cases, operators will drill several wells on a single pad and complete them sequentially.

Each lateral is completed with multiple hydraulic fracture operations, or stages, spaced along the lateral to maximize exposure of the gas to the wellbore. A typical well will use 3 to 6 million gallons of water for drilling and completion; most of this water will come from surface sources. Up to 90% of the water used remains in the formation, with flowback either disposed by state-approved methods or recycled for further use in drilling and completion operations. The Susquehanna River Basin Commission manages surface water withdrawal in this area. Fluids used in most Marcellus operations include water, sand, lubricant gels, hydrochloric acid, antimicrobial agents and scale inhibitors. This type of frac fluid is known as “slickwater”.

Multiple wells are typically drilled from a single pad; in the vicinity of SGL 219 as many as five wells per pad have been drilled. In other areas as many as eight wells per pad are common. Pads and access roads are constructed for long-term use, due to the long productive lives of shale wells and the

possibility that wells will be recompleted or that new wells will be proposed. The initial disturbed area for a typical well pad is 7 to 8 acres. This may include an impoundment for fluids storage, which is used for multiple wells. After pad completion, areas will be reclaimed to state and landowner standards, leaving an operational area of up to 6 acres, including a 5-acre pad and about 1 acre for a half-mile, 16-20 foot access road.

Pipelines would be constructed to transport the gas to the local network, for eventual connection to main high-capacity, often interstate, market lines. A gathering line associated with each pad will be constructed in the access road to transport the gas from the wells on the pad to a main gathering line, which may be placed on public road rights-of-way, cross-country, or a combination of the two. This line will take the gas from the leased area to the local network. Pipeline construction requires a right-of-way width of at least 16 feet. It is unlikely that the length of pipeline required in the leased area will exceed two miles, thus the total new disturbance due to pipeline construction will not exceed 4 acres. Potential pipeline routes will be analyzed as they are proposed, but the PGC has approval authority for pipelines.

Although Marcellus development activity in the northeastern counties expanded rapidly in previous years, it has slowed recently due to several factors. Lower wellhead natural gas prices and production shut in pending infrastructure development, as mentioned above, are primary factors. Other factors include a shortage of gas storage, shortages of engineering and other skilled personnel, the high cost of wells (a single well can cost over \$5 million) and changes required in interstate natural gas transport, such as redirection of gas flow. Should SGL 219 be leased, development is unlikely to occur at a rapid pace.

## **VI. Oil and Gas Occurrence Potential**

Geologists have long known that the Marcellus Shale, as well as other highly organic Devonian shale zones, contained large volumes of natural gas. With the development of appropriate technology to extract the gas, northeastern Pennsylvania, including Warren Township, has been proven to form one of the core areas of the play. Eleven laterals capable of production pass within one mile of the property, and one has recently begun producing. The success rate for the Marcellus play in the area approaches 100%, and typical production volumes are high.

At this time the status of other shallow Devonian shales that overlie the Marcellus is unknown. The Utica Shale, which underlies the Marcellus by more than 5000 feet in this area, does not have production potential here due to overmaturity. No other potentially productive formations are believed to exist in the area.

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## **VII. Oil and Gas Development Potential**

The Pennsylvania Game Commission has provided a draft occupancy plan for SGL 219 that avoids most conflicts with surface uses and resources. This proposal has been used as a basis for this RFDS, and will be evaluated further during the analysis under NEPA. During this time, further consultation with PGC will occur.

Natural gas has been developed in the area since 2007. Infrastructure for natural gas development in the area is still being introduced, but is currently insufficient in providing access to markets for all the wells that have been completed. Horizontal drilling techniques are used to develop wells, with multi-stage fracs used to complete wells. Up to eight wells may be drilled from a single well pad, which may be as large as five acres (six acres with the access road). Pad sizes may be larger if other infrastructure components are sited there.

Public roads in the area may require improvement and intensive maintenance if Marcellus development occurs, due to the number of vehicles involved and the weight of some of the heavy equipment and supplies used. In the event that the PGC does not wish to have cross-country pipeline routes on SGL 219, public road rights-of-way will likely be used for pipeline access. Should the PGC model be approved, Hicky's Rocks Road and the Owego-Montrose Turnpike would provide direct access to facilities on private land. Construction of the main gathering line along public roads would create inconvenience for local residents and recreational users of SGL 219, but would result in no new surface disturbance.

An alternative to the road-based pipeline scenario would be the gathering lines and pipeline installation across undisturbed land. This would create more surface disturbance, and would require further analysis when the proposal is made. The most likely scenario, however, is a combination of road-based and cross-country construction, which would limit both road construction and new surface disturbance.

#### **VIII. RFD Baseline Scenario Assumptions and Discussion**

SGL 219 is managed for game conservation, hunting and other recreational pursuits. Although the PGC, responsible for managing the property, does not have consent authority (granted only to other Federal agencies) to deny Federal lessees access to the property, BLM will accept all suggested stipulations from PGC for analysis. There may be some negotiation required, but the management goals of PGC and BLM are similar, and both agencies wish to provide access to the mineral resources while protecting surface uses and resources.

If PGC issues a mineral development contract for development of its 25% mineral interest, as well as for those tracts in which their interest is 100%, the following will apply:

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*"Without written consent of the Pennsylvania Game Commission (PGC), three (3) well pads will be permitted on the surface of the BLM lease area. Without written consent, no more than 45 acres of the surface land on the lease area will be disturbed which includes pipelines, well pads, access roads, and water handling facilities. The actual well pad locations, pipelines, road use and upgrades, and water handling facility locations must be agreed upon in writing by the PGC as the surface landowner and fractional oil and gas interest owners, and BLM as the fractional oil and gas interest owner. Without PGC's written consent, no compression or water treatment facilities will be permitted on SGL 219. Impoundments on the lease area shall only contain freshwater. Drill cutting shall be disposed of properly off the lease area."*

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## **IX. Surface Disturbance Due to Oil and Gas Activity on All Lands**

In the approximately 20,500 acre analysis area, 11 wells have been drilled from 8 surface locations. Using 8 acres as a reasonable average surface disturbance per pad and access road, a total of 64 acres has been disturbed as a result of oil and gas activity in the analysis area. The amount of surface disturbed as a result of pipeline construction is unknown.

Should a lease issue, an additional short-term disturbance of up to 32 acres could result in the leased area, depending on the number of pads on the lease. A long-term disturbed area of up to 24 acres could result if production is established. If a pipeline is constructed on undisturbed acreage, as much as an additional 4 acres of disturbance could occur. The areas disturbed on adjacent private lands would be nearly the same, for a total of 68 acres of short-term disturbance and long-term disturbance of 52 acres on all lands. Pipeline disturbance on private lands cannot be projected, because the routes of pipeline rights-of-way are negotiated between companies and private landowners.